

## Glossary

$\int$	integral
$\Delta$	difference in; change in
$\gamma$	gamma
$\pi$	pi
$\therefore$	therefore; hence
$\phi$	diameter
$\approx$	nearly equal to
$\theta$	angle
@	at that point
<b>AASHTO</b>	American Association of State Highway and Transportation Officials
<b>abutment</b>	a substructure supporting the end of a superstructure that retains or supports the approach embankment. <i>See also</i> <b>retaining wall</b> and <b>wing wall</b>
<b>adfreezing</b>	the process by which one object becomes adhered to another by the binding action of ice
<b>AFCS</b>	Army Facilities Components System
<b>aggregate</b>	the sand, gravel, or broken stone mixed with cementing material to form a mortar or concrete. The fine material used to produce mortar for stone and brick masonry and for the mortar component of concrete is commonly termed <i>fine aggregate</i> . The coarse material used in concrete only is termed <i>coarse aggregate</i>
<b>AISC</b>	American Institute of Steel Construction
<b>allowable unit stress</b>	the stress per unit of area of the structure material determined to be a safe amount for use (based on quality, condition, and so forth)
<b>allowance</b>	<i>see</i> <b>impact load</b>
<b>anchorage</b>	all members and parts that hold the anchor span of a cantilever bridge in the correct position
<b>anchor bolt</b>	a bolt-like piece of metal threaded and fitted with a nut or a nut and washer at one end only used to fix members of a structure in position
<b>anchor span</b>	the span of a cantilevered bridge that is connected to the moment-resisting support. <i>See also</i> <b>cantilever girder</b>
<b>angle of internal friction</b>	<i>see</i> <b>angle of repose</b>

<b>angle of repose</b>	the batter or slope angle at which a given soil will slide from a higher to a lower elevation; the angle below which the particles of earth are held in equilibrium by the forces of gravity and friction
<b>angle of skew</b>	<i>see</i> <b>skew angle</b>
<b>anisotropy</b>	the property of exhibiting different strengths in different directions
<b>AO</b>	area of operation
<b>approach slab</b>	a heavy, reinforced concrete slab placed on the approach roadway adjacent to and resting on the abutment back wall to carry wheel loads on the approaches directly to the abutment
<b>approx</b>	approximately
<b>apron</b>	a timber, concrete, riprap, paving, or other construction shield that is placed adjacent to substructure abutments and piers to prevent scour
<b>AR</b>	Army regulation
<b>arch</b>	a bow-shaped, nonrigid structure that produces both vertical and horizontal reactions at its supports
<b>arch barrel</b>	an arch ring that extends the width of the structure
<b>arched abutment</b>	<i>see</i> <b>spill-through abutment</b>
<b>arch rib</b>	the curved members used in open-spandrel bridges. Ribs stretch the length of the arch and are often parallel to each other with spandrels running between them
<b>arm</b>	the portion of a drawbridge that forms part or all of the span; the rear or counterweight leaf of a bascule span; the overhanging part of a cantilever bridge that supports the suspended span; the perpendicular distance between the two parallel equal and opposite forces of a moment
<b>armor</b>	a secondary steel member that is installed to protect a vulnerable part of another member (such as steel angles placed over the edges of a joint)
<b>ASTM</b>	American Society for Testing and Materials
<b>AVLB</b>	armored vehicle-launched bridge
<b>axle load</b>	the load borne by one axle of a traffic vehicle, a movable bridge, or other motive equipment or device and transmitted through a wheel or wheels to a supporting structure. <i>See also</i> <b>wheel concentration</b>
<b>backfill</b>	soil (usually granular) placed behind and within the abutment and wing walls to fill the unoccupied part of the foundation excavation
<b>backstay</b>	the part of the main suspension member of a suspension bridge that extends between the tower and the anchorage to resist overturning stresses exerted on the tower by the suspension span. When the backstay extends over the towers, it no longer supports any portion of the bridge's floor system between the tower and the anchorage
<b>back wall</b>	the topmost portion of an abutment above the elevation of the bridge seat that functions as a retaining wall with a live-load surcharge or as a support for the bridge deck and the approach slab

---

<b>backwater</b>	a section of water with an elevation that is increased above normal because of a condition downstream (such as a flood or an ice jam) or because of stream-width contraction beneath a bridge)
<b>balance blocks</b>	blocks of cast iron, stone, concrete, or other heavy material used to adjust the counterbalance of swing and lift spans
<b>balance wheel</b>	one of the wheels attached to the superstructure to maintain the proper balance and lateral stability of the structure by preventing excess rocking or other motion due to wind pressure, shock from operating irregularities, and so forth. When correctly adjusted, the wheel will transmit only its own weight to the track and will revolve without load on its axle
<b>balancing chain</b>	<i>see</i> <b>counterbalancing chain</b>
<b>ballast</b>	filler material (usually broken stone or masonry) used either to stabilize a structure or to transmit a vertical load to a lower level
<b>baluster</b>	one of a set of small pillars supporting a handrail
<b>balustrade</b>	a handrail supported by balusters
<b>barbed anchor bolt</b>	<i>see</i> <b>ragged anchor bolt</b>
<b>bascule bridge</b>	a bridge with a superstructure that swings vertically about a horizontal axis
<b>bascule span</b>	a span of a bridge that swings vertically about a horizontal axis
<b>base coat</b>	<i>see</i> <b>priming coat</b>
<b>base metal</b>	the metal at and adjacent to the surface to be incorporated in a welded joint that will be fused and which will produce a welded joint through coalescence and interdiffusion with the weld
<b>base plate</b>	a plate-shaped piece of steel that is made an integral part of the base of a column, a pedestal, or another member. It transmits and distributes its load directly to the substructure or to another member
<b>batten plate</b>	a plate that covers the joint formed by two abutting metal plates or shapes but does not transmit stress from one to the other; one used instead of lacing to tie together the shapes comprising a built-up member; one in which the bar latticing or lacing of a bolted, riveted, or welded member terminates (sometimes used synonymous with <i>stay plates</i> ). <i>See also</i> <b>stay plate</b>
<b>batter</b>	the inclination of a surface in relation to a horizontal, a vertical, or, occasionally, an inclined plane (commonly noted on detail plans as so many inches to one foot). <i>See also</i> <b>rake</b>
<b>batter pile</b>	a pile driven in an inclined position to resist forces that act in other than a vertical direction. It may withstand these forces or be a subsidiary part of a structure to improve its rigidity. When driven and made fast on the end of a pile bent or pier in a waterway, it acts as a cutwater to divide and deflect floating ice and debris
<b>bay</b>	the area between adjacent stringers of a multibeam structure
<b>bead</b>	a narrow, continuous deposit of weld metal in a single pass of fused filler metal

<b>beam</b>	a piece receiving and transmitting transverse or oblique stresses from externally applied loads when supported at intermediate points or ends. The beam derives its strength from internal bending or flexural stresses. It can be rolled, I-shaped or H-shaped metal; I-shaped metal made of plates and angles; or other shapes bolted, riveted, or welded together (built-up beams)
<b>bearing failure</b>	a crushing under an extreme compressive load on an inadequate support; a shear failure in the supporting soil when a footing or pile applies excessively high pressures
<b>bearing pad</b>	a thin sheet of material placed between a masonry plate and the masonry-bearing surface. It is used to fill voids caused by imperfection of the masonry plate and bearing surface, to seal the interface, and to aid in even distribution of loads at the interface
<b>bearing pile</b>	a pile that receives its support in bearing through the tip or lower end of the pile
<b>bearing plate</b>	a steel plate placed between stringers and the supporting seat to distribute vertical bridge loads and to prevent crushing or flange- and web-bending failures
<b>bearing seat</b>	a prepared horizontal surface at or near the top of a substructure unit upon which the superstructure bearings are placed
<b>bedrock</b>	a natural mass formation of sedimentary or metamorphic rock
<b>benchmark</b>	a point of known elevation and location
<b>bent</b>	a supporting unit of a trestle or viaduct structure made of two or more columns or column-like members connected by a cap, a strut, or another member. This connecting member distributes superimposed loads on the bent. When combined with a system of diagonal or horizontal bracing attached to the columns, the entire construction functions somewhat like a truss distributing its loads into the foundation
<b>berm</b>	the line of intersection between the top surface of an approach embankment or causeway and the surface of the side slope; a horizontal bench located at the toe of the slope of an approach cut, embankment, or causeway to strengthen and secure its underlying material
<b>blanket</b>	a streambed protection placed adjacent to abutments and piers and covering the streambed for an adequate distance to resist scour; a deposit of stones of varying sizes or a timber framework loaded with stones or adaptable ballasting material for ballasting and protecting from displacement
<b>block abutment</b>	<i>see</i> <b>straight abutment</b>
<b>bollard</b>	one of a series of short posts that is used for diverting or excluding motor vehicles from a road
<b>bolster</b>	a block-like wood, metal, or concrete member that supports a bearing on top of a pier cap or abutment bridge seat. It adjusts bearing heights (thus avoiding bridge-seat construction to the crown of the roadway), provides an area that may be ground to a precise elevation, or raises a bearing above moisture and debris that may collect on the bridge seat. <i>See also</i> <b>bridge pad</b>

<b>bolted joint</b>	<i>see riveted joint</i>
<b>bond</b>	the grip of concrete on reinforcing bars that prevents slippage; the mechanical force developed between two concrete masses when one is cast against the already hardened surface of the other
<b>bond stress</b>	the stress developed by the force tending to produce movement or slippage at the interface between the concrete and the metal reinforcement bars or other shapes in reinforced concrete construction
<b>bowstring truss</b>	any truss with its top-chord members polygonally arranged like a parabolic truss; one with a top chord conforming to the arc of a circle or an ellipse. <i>See also</i> <b>parabolic truss</b>
<b>box beam</b>	a rectangular-shaped precast and prestressed concrete beam. These beams may be side by side or connected laterally and are used to form a bridge deck with or without a cast-in-place slab or topping. The units act similar to a slab. They act as a beam when spread and when a cast-in-place slab is used
<b>bracing</b>	a system of tension and/or compression members connected to the main members of a structure for support. This system transfers wind, dynamic, impact, and vibratory stresses to the substructure and gives rigidity throughout the complete assemblage. Types of bracing include lateral (which resists transverse forces) and longitudinal (which resists longitudinal forces). <i>See also</i> <b>cross frames; diaphragm; sway brace; and transverse bracing</b>
<b>bracket</b>	a projecting support or brace fixed on two intersecting members to transfer reactions or shear stress from one to the other, to strengthen and render a joint connection of the members more rigid, or to fix one member in position
<b>breast wall</b>	the portion of an abutment between the wings and beneath the bridge seat that supports the superstructure loads and retains the approach fill. <i>See also</i> <b>face wall and stem</b>
<b>brick veneer</b>	<i>see stone facing</i>
<b>bridge</b>	a structural means of transit for pedestrians or vehicles above the land or water surface (whether natural or artificial). The essential parts of a bridge are the substructure with its abutments and/or piers supporting the superstructures; the superstructure slab, girder, truss, arch, or other spans supporting the roadway loads and transferring them to the substructure; and the roadway receiving and transmitting traffic loads. <i>See also</i> <b>culvert</b>
<b>bridge pad</b>	the raised, leveled area on which the pedestal, shoe, sole, plate, or other members take bearing by contact. <i>See also</i> <b>bolster</b>
<b>bridge seat</b>	the top surface of an abutment or pier that holds and supports the superstructure span. For an abutment, it is the surface forming the support for the superstructure and from which the back wall rises. For a pier, it is the entire top surface
<b>bridge-seat bearing area</b>	<i>see bridge pad</i>
<b>bridge-seat pedestal</b>	a block-like member between the bridge seat and the bearings that supports the superstructure. <i>See also</i> <b>bolster</b>

<b>bridge site</b>	the selected position or location of a bridge
<b>bridging</b>	the cross bracing fastened between wooden floor stringers (usually at the one-third span points) to increase the floor rigidity, uniformly distribute the live load, and minimize the effects of impact and vibration
<b>brush curb</b>	a narrow curb (9 inches wide or less) that prevents a vehicle from brushing against the railing or parapet
<b>buckle</b>	to fail by an inelastic change in alignment, usually because of compression
<b>buffer</b>	a mechanism designed to absorb the concussion or impact of a moving superstructure or another part when it swings, rises, or falls to its limiting position of motion
<b>built-up column</b>	a column comprised of several plates and angles or other shapes united by bolting, riveting, or welding to render the entire assemblage a unit. Commonly described as a <i>plate girder</i>
<b>built-up girder</b>	<i>see</i> <b>built-up column</b>
<b>bulkhead</b>	a retaining timber, steel, or reinforced concrete structure or a barrier of wooden timbers. Bulkheads consist of driven piles supporting a wall or a wall-like structure resisting the earth or other material and preventing sliding and overturning
<b>bumper</b>	<i>see</i> <b>buffer</b>
<b>buttress</b>	a bracket-like wall that projects from a wall to strengthen and stiffen it against overturning forces that are applied to the opposite face. A buttress must touch the wall it reinforces, although it may be integral with or independent of it. All parts of a buttress act in compression. <i>See also</i> <b>counterfort</b>
<b>buttressed wall</b>	a retaining wall with projecting buttresses to provide strength and stability
<b>butt weld</b>	a weld that joins two members end to end
<b>cable</b>	one of the main members of a suspension bridge that receives bridge floor loads and transmits them to the towers and anchorages. <i>See also</i> <b>suspension bridge</b>
<b>cable band</b>	a steel casting with bolts or other fasteners fixing it securely on the cable of a suspension bridge and preventing the band from slipping from its correct location
<b>camber</b>	the slight arch or convex curvature provided in a span structure to compensate for dead-load deflection and to secure a more substantial and aesthetic appearance than uniformly straight lines produce; the superelevation given to the extreme ends of a swing span during erection to diminish the deflection (droop) of the arms when in the open position, cantilevered from the center bearing; a projecting beam, truss, or slab supported at one end only
<b>cantilever abutment</b>	an abutment in which the stem or breast wall is fixed rigidly to the footing. Acting as a cantilever beam, the stem transmits the horizontal earth pressure to the footing, which maintains stability by virtue of the dead weight of the abutment and of the soil mass resting on the rear portion (or heel) of the footing

---

<b>cantilever beam</b>	<i>see</i> <b>cantilever girder</b>
<b>cantilever bridge</b>	a bridge with a cantilevered superstructure
<b>cantilever girder</b>	a girder or truss with its members or parts arranged so that one or both of its end portions extend beyond the point or points of support. The girder may consist of two projecting ends counterbalanced over a center support, two projecting ends with an intermediate suspended portion in which the weight is completely counterbalanced by the anchor spans or anchorages, or a projecting end counterbalanced by a portion extending in the opposite direction beyond the point of support or by an uplift-resisting anchorage
<b>cantilever span</b>	a superstructure span of a cantilever bridge composed of two cantilever arms or of a suspended span connected with one or two cantilever arms
<b>cantilever truss</b>	<i>see</i> <b>cantilever girder</b>
<b>cap</b>	the top piece or member of a viaduct, trestle, or frame bent serving to distribute the loads on the columns and to hold them in their proper relative positions. <i>See also</i> <b>pier cap</b> and <b>pile cap</b>
<b>capillary action</b>	the process by which water is drawn from a wet area and transported to a dry area through the pores of a material
<b>capstone</b>	the top stone of a masonry pillar, a column, or another structure requiring the use of a single capping element; one of the stones used in constructing a stone parapet to make up its top (weather) course
<b>catch basin</b>	a box-shaped receptacle fitted with a grilled inlet and a pipe outlet drain to collect rain water and floating debris from the roadway surface and to retain solid material for periodic removal. Catch basins are usually installed beneath a bridge floor or within the approach roadway, with the grilled inlet adjacent to the roadway curb
<b>catchment area</b>	<i>see</i> <b>drainage area</b>
<b>catwalk</b>	a narrow, permanent or temporary walkway for access to some part of a structure. <i>See also</i> <b>inspection ladder</b>
<b>cellular abutment</b>	an abutment of reinforced concrete boxes in which the space between the wings, the breast wall, the approach slab, and the footings is hollow. On some bridges, curtain walls between the pier and the abutment simulate a cellular abutment
<b>cement matrix</b>	the binding medium in mortar or concrete produced by hardening cement
<b>cement paste</b>	the plastic combination of cement and water that supplies the cementing action in concrete
<b>center bearing</b>	all parts (including pedestal castings, the pivot, and discs) that support the entire dead load of a swing span when the end lifts are released or the span is revolving open or closed
<b>center discs</b>	the bronze, steel, or other metal enclosed in the pivot of a center-bearing swing span to reduce its frictional resistance

<b>centering</b>	the support for formwork for any slab, beam, or other horizontal concrete structure on which the arch ring is constructed. Centering is usually timber or metal framework, with its top portion shaped to conform with the arch intrados and covered with lagging or with bolsters spaced to permit treatment of the mortared joints of stone masonry
<b>centering device</b>	the mechanical arrangement or device that guides the span of a bascule or a vertical lift to its position on its supports when moving from open to closed
<b>center lock</b>	a locking device that transmits shear at the centerline of a double-leaf bascule or double-swing span bridge. This device eliminates deflection and vibration at the center of the span
<b>center wedges</b>	the assembly of pedestals and wedges located upon the pivot pier beneath the loading girder on a swing bridge. Operated mechanically, it receives the pivot-pier live loads and transmits them directly to the substructure, thus relieving the pivot casting from all (or nearly all) live-load stress
<b>CH</b>	clay, high plasticity
<b>channel profile</b>	the longitudinal section of a channel
<b>chase</b>	a channel, groove, or elongated recess built into a structure surface to receive a part of a joint or structure
<b>check analysis</b>	<i>see</i> <b>ladle analysis</b>
<b>chord</b>	the upper (top) and lower (bottom) longitudinal members of a truss that extend the full length and carry the tensile and compressive forces. The chords may be parallel (the upper one may be polygonal or curved [arched] and the lower one horizontal) or both may be polygonal [broken chords]). The panel points of polygonal top chords are parabolic chords (they follow the arc of a parabola)
<b>chord members</b>	the trusses that are commonly divided lengthwise into panels, the length of each being termed a panel length. The corresponding members of the chords are described as upper (top) chord members and lower (bottom) chord members
<b>circular arch</b>	an arch in which the intrados surface is a portion of the surface of a right circular cylinder
<b>CL</b>	clay, low plasticity
<b>clearance</b>	the unobstructed space provided on or under a bridge superstructure for the free passage of vehicular and pedestrian traffic, a river or stream with its surface burden of floating debris, or a navigation craft. Clearance is also provided for the free assembly and adjustment of the elements or members of a structure and for the variations in dimension due to workmanship, temperature changes, and minor irregularities. Clearance is sometimes described as <i>go-and-come</i> or <i>play allowance</i> . <i>See also</i> <b>clear headway</b>
<b>clear headway</b>	the vertical clearance beneath a bridge structure for navigation. In tidal waters, headway is measured above mean high-tide elevation. <i>See also</i> <b>clearance</b>



---

<b>clear span</b>	the unobstructed space or distance between the substructure elements measured between faces of abutments and/or piers. When a structure is located on a navigable waterway, the clear span is measured at mean low-water elevation and may be the distance between guard or fender piers, dolphins, or other constructions to protect navigation
<b>clevis</b>	a forked device used to pin the end of a rod on a gusset plate or other structural part. The clevis may be adjustable or fixed. An adjustable member with a fixed clevis at one end may be fitted with a thread and nut at its opposite end, while one having fixed clevises at each end may be fitted with either a sleeve nut or a turnbuckle in its midlength portion. Lateral bracing and tie-rod diagonals on steel trusses often use clevises
<b>clevis bar</b>	a member consisting of a rod having upset threaded ends fitted with clevises for engaging end-connection pins. For later adjustment, it has right- and left-hand end threads or it has a sleeve nut or a turnbuckle within its length with right- and left-hand end threads on each of its sections and its clevises forged integrally with the body sections of the bar
<b>clip angle</b>	<i>see connection angle</i>
<b>closed-spandrel arch</b>	an arch bridge with earth filling the space between the deck and the bottom of the arch
<b>coarse aggregate</b>	<i>see aggregate</i>
<b>coefficient of thermal expansion</b>	the unit strain produced in a material by a change of one degree in temperature
<b>cofferdam</b>	an open, box-like structure constructed to surround the area to be occupied and to permit draining of the enclosure so that excavation may be effected in open air. In its simplest form, the dam consists of interlocking steel sheet piles
<b>cold work</b>	the rolling or bending of material at ordinary room temperature or of steel under concentrated forces
<b>collision strut</b>	a redundant member reinforcing the inclined end post of a through truss against damage from vehicular traffic. The strut joins the end post at a height above the roadway perceived to be the location of collision contact and connects the post with the first interior bottom-chord panel point. The use of collision struts in highway bridges is limited
<b>column</b>	a member resisting compressive stresses, vertical to the bottom chord of a truss and common to two truss panels
<b>composite bridge</b>	a bridge with a concrete deck that has longitudinal main load-bearing members
<b>composite joint</b>	a joint in which combined mechanical devices or such devices combined with a fusion weld develop its strength, rigidity, and so forth. Using joints is undesirable due to the uncertain functioning of composite joints
<b>compound roller</b>	a large, hollow roller holding a large, solid cylinder surrounded by smaller solid rollers with circular spacing bars engaging their ends. The roller is commonly hollow at the center to permit observation of its interior material

<b>compression</b>	the stress that occurs when force is applied at the ends of a member. The stress is inward toward the center of the member
<b>concrete</b>	a composite material consisting of a binding medium (such as cement and water) within which are embedded particles or fragments of aggregate (a relatively inert mineral filler)
<b>concrete box girder</b>	a large, reinforced or prestressed concrete, box-shaped beam, usually multicelled with several interior webs. The bottom slab of the girder serves as a flange only, while the top slab is both a flange and a transverse deck slab
<b>connection angle</b>	a piece or pieces of material shaped in an angle serving to connect two elements of a member or two members of a structure
<b>consolidated soil foundation</b>	a foundation of soft soil made more resistant to its loads by consolidating natural material, adding material such as sand and gravel into the soft material, and injecting cementing materials into the soil mass that will produce consolidation by lapidification
<b>consolidation</b>	the time-dependent change in the volume of a soil mass under compressive load that occurs when water slowly escapes from the pores or voids of the soil. The soil skeleton is unable to support the load and changes structure, thereby reducing its volume and producing vertical settlements
<b>continuous girder</b>	any girder, span, or truss that extends without interruption over one or more intermediate supports
<b>continuous span</b>	<i>see</i> <b>continuous girder</b>
<b>continuous truss</b>	<i>see</i> <b>continuous girder</b>
<b>continuous weld</b>	a weld that extends the entire length of a joint
<b>coping</b>	the top stone layer of a retaining wall, pier, abutment, wing wall, and so forth that projects beyond the surface of the masonry below. The top surface is usually battered (washed) to prevent the accumulation of rain or other moisture
<b>corbel</b>	a projecting part of a structure that supports a brace, a short beam, or another member or that serves as part of the architectural treatment of the structure. In stone and brick masonry construction, this form of corbel is called a <i>corbel course</i> , implying greater length than that of a simple corbel
<b>corbel course</b>	<i>see</i> <b>corbel</b>
<b>corrosion</b>	the general disintegration and wasting of surface material through oxidation, temperature, decomposition, and other natural agents
<b>cos</b>	cosine
<b>cotter bolt</b>	a bolt with a head at one end and a round hole with a cotter pin or a hexagonal slot with a tapered wedge near the opposite end. Cotter bolts usually have one or two washers. A cotter bolt with a key is sometimes called a <i>key bolt</i>
<b>counter</b>	a diagonal truss member located at the midspan panel of the truss. Counters function only when the span is partially loaded. The dead load of the truss does not stress the counter. <i>See also</i> <b>web members</b>
<b>counterbalancing chain</b>	chains in a vertical-lift bridge that serve to counteract the varying weight of the supporting cables incidental to the span movements

---

<b>counterfort</b>	a bracket-like wall that projects from another wall to resist tensile and bending stresses. Counterforts are integrally built with or otherwise securely attached to the side of and extend partially or completely to the top of the wall they reinforce. <i>See also</i> <b>buttress</b>
<b>counterforted abutment</b>	an abutment that develops resistance to bending moment in the stem through counterforts. This permits the breast wall to be a horizontal beam or slab spanning between counterforts rather than a vertical cantilever slab
<b>counterforted wall</b>	a retaining wall with projecting counterforts to provide strength and stability. <i>See also</i> <b>retaining wall</b>
<b>counterweight</b>	a weight used to counterbalance the weight of a movable part such as a bascule leaf or a vertical-lift span
<b>counterweight well</b>	an enclosed space beneath the approach end of a bridge floor that accommodates the counterweight and its supporting frame during span movement on certain types of bascule-bridge structures
<b>course</b>	a layer made of either cut or uncut pieces of stone with horizontal or slightly longitudinally inclined joints in stone masonry; a layer of bricks in mortar (in brick masonry)
<b>cover</b>	the clear thickness of concrete between a reinforcing bar and the concrete surface
<b>covered bridge</b>	a wooden bridge with an adaptable truss. To prevent or delay deterioration of the timbers caused by moisture in the joints, a housing of fastened materials covers the structure or its trusses. A covered bridge may be a deck or a through structure that may use pony trusses
<b>cover plate</b>	a plate used with flange angles or other shapes to provide an additional flange section on a girder, column, strut, or similar member
<b>cracking</b>	visible cracks in an overlay indicating cracks in the concrete below
<b>cradle</b>	the lateral distance from the midpoint of one of the main cables to a straight line drawn between its support points on the towers
<b>creep</b>	an inelastic deformation that increases with time while the stress is constant
<b>crib</b>	a structure with compartments or coffer full or partly full of satisfactory material for supporting the structure. It may also serve as a training wall averting changes in shore and bank locations. The exterior portion may be planked or sheet-piled to protect the crib against erosion or floating debris. <i>See also</i> <b>dike</b>
<b>crimped stiffener</b>	a stiffener forged at its ends to fit on the web and web legs of the flange angles of a plate girder
<b>cross fall of roadway</b>	<i>see</i> <b>crown of roadway</b>
<b>cross frames</b>	transverse bracings between two main longitudinal members. <i>See also</i> <b>bracing</b> and <b>diaphragm</b>
<b>cross girder</b>	large timber, metal, and reinforced concrete girder members placed perpendicular to and connected on the main girders or trusses of a bridge span, including intermediate and end floor beams

<b>cross wall</b>	<i>see</i> <b>diaphragm wall</b>
<b>crown of roadway</b>	the crest line of the convexed surface or the vertical dimension measuring the convexed or raised surface from gutter to crest
<b>C-shaped beams</b>	steel channels
<b>cu ft</b>	cubic foot; cubic feet
<b>culvert</b>	a small bridge entirely below the elevation of the roadway surface, with no integral parts. Structures less than 20 feet in span are culverts, even though they support traffic loads directly. Structures over 20 feet in span and parallel to the roadway are <i>bridges</i>
<b>curb</b>	a stone, concrete, or wooden barrier paralleling the side of the roadway. Curbs guide vehicles and safeguard bridge trusses, railings, and other structures outside the roadway. Curbs also protect pedestrians on sidewalks from colliding with vehicles
<b>curb inlet</b>	<i>see</i> <b>scupper</b>
<b>curtain wall</b>	a thin, nonbearing masonry wall; a thin, vertical, and integral part of a culvert paving slab that protects the culvert against undermining by stream scour; a wall uniting the pillar or shaft portions of a dumbbell pier and serving as a frame composed of struts and braces to make the entire structure act integrally
<b>curve banking</b>	<i>see</i> <b>superelevation</b>
<b>curved wing wall</b>	a wall forming either a convex or concave arc flaring from the alignment of the abutment breast wall
<b>curves in plan and profile</b>	a roadway may be curved in its lateral alignment, its vertical contour, or in both its alignment and contour
<b>cut or cutting</b>	that portion of construction produced by the removal of the natural formation of earth or rock, whether sloped or level. The terms <i>side-hill cut</i> and <i>through cut</i> describe the resulting cross sections commonly encountered
<b>cut slope</b>	the inclined surface of an approach cut ending with a ditch or gutter at its base, which in turn serves to remove accumulations of water from all areas drained into it
<b>cylinder pier</b>	<i>see</i> <b>pier</b>
<b>CZ</b>	combat zone
<b>DA</b>	Department of the Army
<b>DC</b>	District of Columbia
<b>dead load</b>	a static load due to the weight of the structure
<b>deadman</b>	an anchorage member engaging the end of a stay rod, cable, or other tie-like pieces. The deadman resists the stresses of tie members and restrains and holds structure members in position against horizontal movement
<b>debris rack</b>	a grill barrier used to intercept debris above a sewer or culvert inlet
<b>deck</b>	the part of a bridge that directly supports traffic. The deck distributes the load to beams and stringers and may be the main supporting element of a bridge. It may be reinforced concrete, timber, a steel plate or grating, or the top surface of abutting concrete members or units

<b>deck bridge</b>	a bridge with its floor elevation at or above the elevation of the uppermost part of the superstructure
<b>decking</b>	the flooring of bridges with wooden floors. Decking does not include floor stringers, floor beams, or flooring-support members
<b>deformation</b>	dimensional changes that occur when stress in a material is less than the yield point. The material will return to its original shape if the stress is removed
<b>deformed bars</b>	<i>see</i> <b>mechanical bond</b>
<b>deg</b>	degree(s)
<b>depth of truss</b>	the vertical distance between the centerlines of action of the top and bottom chords of trusses with parallel chords
<b>design load</b>	the load of concentrations used to determine the stresses, stress distributions, and the cross-sectional areas and compositions of a bridge structure. The design's fixed load or loadings are often composite rather than actual, but are based on a study of vehicle types
<b>diagonal</b>	<i>see</i> <b>web members</b>
<b>diagonal stay</b>	a cable support extending diagonally from the tower to the roadway to add stiffness to the structure and to diminish the deformations and undulations caused by traffic in a suspension bridge
<b>diam</b>	diameter
<b>diaphragm</b>	a reinforcing plate or member that is placed within a member or deck system to distribute stresses and to improve strength and rigidity. <i>See also</i> <b>bracing</b> and <b>cross frames</b>
<b>diaphragm wall</b>	the walls of a reinforced concrete caisson or box-like structure that divides its interior space into reinforcing compartments; a wall built transversely to the longitudinal centerline of a spandrel arch to tie together and reinforce the spandrel walls and to provide a support for the floor system. The diaphragms of an arch span may have manholes to allow inspection
<b>dike</b>	a soil embankment constructed to prevent inundation by an adjacent area. A dike prevents stream erosion and localized scour and directs the current so that debris will not accumulate on bottomland adjacent to approach embankments or portions of the structure. This term is sometimes misapplied to crib construction. <i>See also</i> <b>crib</b>
<b>dimension stones</b>	stones quarried with the dimensions large enough to provide cut stones with given finished dimensions (commonly called <i>quarry face</i> or <i>rock face</i> )
<b>distribution girder</b>	a beam or girder-like member forming a part of the frame that transmits loads to the drum girder of a rim-bearing swing span
<b>ditch</b>	<i>see</i> <b>drain</b>
<b>diversion drain</b>	an open, top-paved drain for diverting and conveying water from a roadway gutter down the inclined surface of a bridge-approach embankment or causeway

<b>diversion flume</b>	<i>see</i> <b>diversion drain</b>
<b>dolphin</b>	a group of piles driven close together and placed to protect portions of a bridge exposed to possible damage by collision with river or marine traffic
<b>double lattice</b>	<i>see</i> <b>lattice</b>
<b>double-leaf bascule bridge</b>	a bridge that has spans with two bascule leaves
<b>double-movable bridge</b>	a bridge in which the arms of two adjacent swing spans or the leaves of two adjacent bascule spans are joined at or near the center of the navigable channel to produce the clear span for navigation
<b>dowel</b>	a short, round or square length of metal used to attach and prevent movement and displacement of wooden, stone, concrete, or metal pieces when placed in a hole in their contact surfaces. Dowels generally resist shear forces, but footing dowels in reinforced concrete walls and columns resist bending forces. <i>See also</i> <b>drift bolt</b>
<b>drain</b>	a trench or trough-like excavation made to collect water. A drain collects and conveys water (a ditch may only serve to collect water). A gutter is a paved drain commonly built in conjunction with the curbs of the roadway or closely adjacent to the paved portion of the roadway
<b>drainage</b>	a construction or appliance that intercepts and removes water
<b>drainage area</b>	the place where the run-off water goes when passing beneath a bridge or passing a specific location in a river or stream
<b>drain hole</b>	an open hole or embedded pipe that provides an exit for water or other liquid matter that might otherwise accumulate. In areas exposed to freezing temperatures, these holes prevent damage from expansion caused by freezing
<b>drawbridge</b>	a bridge over navigable water with a movable superstructure span of any type that frees the channel from obstructing navigation
<b>draw rest</b>	a block of masonry, a rigid metal frame, or another support on a fender or guard pier that is equipped with a latch block for holding open a swing span
<b>draw span</b>	a swing or a retractile superstructure span of a bridge over a navigable stream, river, lake, canal, tidal inlet, gut, or strait. <i>See also</i> <b>movable bridge</b>
<b>dressed rubble</b>	<i>see</i> <b>rubble</b>
<b>drift bolt</b>	similar to a dowel, except drift bolts are commonly driven in holes having a diameter slightly less than the bolts. The difference is more a matter of term usage rather than of functions to be performed. <i>See also</i> <b>dowel</b>
<b>drip bead</b>	a channel or groove in the bottom of an exposed part of a masonry structure that stops rainwater and keeps it from dripping on surfaces below the projection
<b>drip hole</b>	<i>see</i> <b>drain hole</b>

---

<b>drop inlet</b>	a box-like construction built integrally with the upstream end of a culvert, which may include a grating. The inlet allows water to flow in at its top and to center the culvert within its bottom portion. If the base is constructed to form a sump below the inlet elevation of the culvert, the inlet may retain material likely to become lodged in the culvert
<b>drum girder</b>	the circular-plate girder forming a part of a swing-bridge turntable that transfers its loads to the rollers and the track on which they travel. When the swing span is closed, the drum-girder track receives the superstructure loads and transmits them to the substructure bearing area beneath the track
<b>ductility</b>	the ability to withstand nonelastic deformation without rupture
<b>dyke</b>	<i>see</i> <b>crib and dike</b>
<b>efflorescence</b>	a white deposit on concrete or brick that is caused by crystallization of soluble salts brought to the surface by moisture in the masonry
<b>el</b>	elevation
<b>elastic</b>	<i>see</i> <b>deformation</b>
<b>elastomer</b>	a natural or synthetic, rubber-like material
<b>electrolytic corrosion</b>	corrosion resulting from galvanic action
<b>element</b>	a piece of material forming a part of a structure
<b>elliptic arch</b>	an arch (fitted to stone masonry arches) in which the intrados surface is half the surface of an elliptical cylinder. This terminology is sometimes incorrectly applied to a multicentered arch
<b>end block</b>	the thickening of the web or an increase in the beam width at the end to provide adequate anchorage bearing for the posttension wires, rods, or strands on a prestressed concrete beam
<b>end floor beam</b>	<i>see</i> <b>floor beam</b>
<b>end hammer</b>	the hammering action of an end-lift device on its pedestal or bearing plate. End hammer occurs when the lifting device is improperly adjusted and traffic movements cause deflections and vibrations
<b>end lift</b>	the mechanism of wedges, toggles, link-and-roller, rocker-and-eccentric, or other devices combined with shafts, gears, or other needed parts to remove the camber (droop) of a swing span
<b>end post</b>	the end compression member of a truss, either vertical or inclined in position and extending from the top chord to the bottom chord. It serves to transmit all of the truss shear loading to the superstructure
<b>enr</b>	engineer
<b>epoxy</b>	a synthetic resin that cures or hardens by a chemical reaction between components that are mixed together shortly before use
<b>eq</b>	equation(s)
<b>equalizer</b>	a balance lever engaging the counterweight and the suspending cables of a vertical-lift span to adjust and equalize the stresses in the latter

<b>equilibrium</b>	the condition in which the forces acting on a body produce no external effect or movement in statics
<b>equivalent uniform load</b>	a load with a constant intensity per unit of its length. When used to determine the stresses in a structure, this load produces a very similar or equal effect to that of a live load with vehicle or wheel concentrations spaced at varying distances
<b>expansion bearing</b>	a device or assemblage that transmits a reaction from one member or part of a structure to another. The expansion bearing overcomes sliding, rolling, or other friction conditions to permit longitudinal movement caused by temperature changes and superimposed loads without transmitting a horizontal force to the substructure
<b>expansion dam</b>	the expansion joint or that part of the expansion joint that serves as an end form for placing concrete at a joint
<b>expansion joint</b>	a joint designed to provide a means for expansion and contraction that is caused by temperature changes, loadings, and so forth
<b>expansion pedestal</b>	<i>see</i> <b>expansion shoe</b>
<b>expansion rocker</b>	an articulating assembly that forms part of the movable end of a girder or truss and facilitates longitudinal movements caused by temperature changes and superimposed loads
<b>expansion roller</b>	a cylinder that is mounted so that when it revolves it facilitates movements caused by temperature changes, loadings, and so forth. <i>See also</i> <b>roller nest</b>
<b>expansion shoe</b>	a member or assemblage that provides a means for expansion, contraction, or other longitudinal movement. Anchor bolts fix the masonry plate or casting in position, and the superimposed shoe plate or pedestal is free to move longitudinally on it or on intervening rollers but is restrained from transverse movement. A <i>shoe</i> permits movement by sliding. A <i>pedestal</i> secures a somewhat greater total depth and permits movement by sliding or rolling
<b>extrados</b>	the curved surface of an arch that is farthest from its longitudinal axis or axes; the curve defining the exterior surface of an arch
<b>eyebars</b>	a rectangular bar member that has enlarged forged ends or heads with holes through them for engaging connecting pins. An adjustable eyebars has two sections fitted with upset threading engaging a sleeve nut or a turnbuckle
<b>eyebolt</b>	a bolt with a forged hole or loop at one end to allow anchorage of a cable, a hooked rod, other parts of the bridge, or unrelated equipment or structures. <i>See also</i> <b>hook bolt</b> and <b>ringbolt</b>
<b>F</b>	Fahrenheit
<b>face stones</b>	the stones exposed to view in the drop surfaces of abutments, piers, arches, retaining walls, or other stone structures
<b>face wall</b>	the outermost spandrel walls providing the face surfaces of the completed structure. <i>See also</i> <b>breast wall</b> and <b>spandrel</b>
<b>falsework</b>	a wooden or metal framework built to support the weight of a structure without appreciable settlement and deformation until it can stand alone. Falsework helps construction operations and provides for economical removal and salvaging of material



---

<b>fanged anchor bolt</b>	<i>see</i> <b>ragged anchor bolt</b>
<b>fascia</b>	a light, stringer-like outside member spanning longitudinally between cantilever brackets that support large overhangs on girder or beam bridges. A fascia is designed for effect rather than strength and rigidity, although it may involve both
<b>fascia girder</b>	an exposed outer girder of a span that is sometimes treated to provide an attractive appearance
<b>fatigue</b>	the tendency of a member to fail at a lower stress when subjected to cyclical loading rather than static loading
<b>felloe guard</b>	<i>see</i> <b>wheel guard</b>
<b>fender</b>	a structure that is placed upstream close to a pier or upstream and downstream from the center pier and end piers or abutments of a superstructure span to protect the superstructure or an open span from collision with floating debris, ice, or other waterborne traffic
<b>field coat</b>	a coat of paint that is applied after the structure is assembled and its joints are completely bolted, riveted, or welded together. This is often part of the field erection procedure
<b>fill</b>	material (usually earth) used to raise or change the surface contour of an area or to construct an embankment
<b>filler</b>	a piece used in wooden and structural-steel construction to fill a space beneath elements such as a batten, splice plate, gusset, connection angle, or stiffener
<b>filler metal</b>	metal prepared in wire, rod, electrode, or other adaptable forms to be fused with the structure metal in the formation of a weld
<b>filler plate</b>	<i>see</i> <b>filler</b>
<b>fillet</b>	a curved portion forming a junction of two surfaces that would otherwise intersect at an angle. A fillet is used to disseminate and relieve shrinkage or other stresses, to allow movement not otherwise possible, and to facilitate the placement and removal of concrete forms
<b>fillet weld</b>	a weld that joins intersecting members by depositing weld metal to form a near-triangular or fillet-shaped junction of the member surfaces. This weld serves to unite the intersecting surfaces of two elements of a member
<b>filling</b>	<i>see</i> <b>fill</b>
<b>fine aggregate</b>	<i>see</i> <b>aggregate</b>
<b>finger dam</b>	expansion joint in which the opening is spanned by meshing steel fingers or teeth
<b>fish belly</b>	a term that is applied to a girder or truss with its bottom flange or chord haunched or bow-shaped with the convex side downward. <i>See also</i> <b>lenticular truss</b>
<b>fixed bearing</b>	the plates, pedestals, or other devices that receive and transmit the reaction stresses of a beam, slab, girder, truss, arch, or other superstructure span to the substructure or to another supporting member or structure

<b>fixed bridge</b>	a bridge with superstructure spans fixed in position. The construction may allow for expansion and contraction from temperature changes, loading, and so forth
<b>fixed-end arch</b>	<i>see</i> <b>voussoir arch</b>
<b>fixed span</b>	an immovable superstructure span anchored in its location on the substructure
<b>flange</b>	the part of a rolled I-shaped beam or built-up girder extending transversely across the top and bottom edges of the web. Flanges carry the forces of internal resisting moment and may consist of angles, plates, or both
<b>flange angle</b>	an angle used to form a flange element of a built-up girder, column, strut, and so forth
<b>flare</b>	the lateral distance from the cable support on the tower to the anchorage
<b>flared wing wall</b>	a wall that forms an angle with the alignment of the abutment breast wall by receding. It also deflects water and floating debris into the waterway of the bridge, which protects the approach embankment against erosion
<b>floated face</b>	<i>see</i> <b>mortar</b>
<b>floating bridge</b>	a bridge that is similar to a pontoon bridge except that its parts providing buoyancy and supporting power may be logs or squared timbers held in position under a plank floor with lashing pieces, chains, or ropes or made of hollow cellular construction
<b>floating foundation</b>	a soil-supported raft or mat foundation with low bearing pressures. <i>See also</i> <b>foundation</b>
<b>floodgate</b>	a gate installed in a culvert or bridge waterway to prevent the ingress of floodwater or tidewater to the area drained by the structure
<b>floor</b>	<i>see</i> <b>deck</b>
<b>floor beam</b>	a beam or girder transverse to the general alignment of the bridge with its ends framed on the columns of bents and towers or on the trusses or girders of superstructure spans. A floor beam at the extreme end of a girder or truss span is an <i>end floor beam</i>
<b>floor system</b>	the complete framework of floor beams and stringers or other members supporting the bridge floor and traffic loading, including impact
<b>flow line</b>	the surface of a watercourse
<b>flux</b>	a material that dissolves and removes oxides from metal during the welding process and protects the weld from oxidation during the fusion process. Flux may be in the coating on a metal-stick electrode or a granular mass covering the arch in submerged arc welding
<b>FM</b>	field manual
<b>footbridge</b>	a bridge designed and constructed for pedestrian traffic
<b>footer</b>	<i>see</i> <b>footing</b>

---

<b>footing</b>	the enlarged or spread-out lower portion of a substructure that distributes the structure load to the earth or to supporting piles. Concrete slabs most often use footings, although stone piers also use footings or <i>plinth</i>
<b>footing course</b>	<i>see</i> <b>footing</b>
<b>footwall</b>	<i>see</i> <b>toe wall</b>
<b>forms</b>	the wood or metal construction used for receiving, molding, and sustaining a plastic mass of concrete (to the dimensions, outlines, and details of surfaces planned for) while it hardens. <i>Lagging</i> refers to the surface-shaping areas producing the intradoses of arches or other curved surfaces, especially when strips are used
<b>formwork</b>	<i>see</i> <b>forms</b>
<b>foundation</b>	the supporting material on which the substructure portion of a bridge is placed. A <i>natural</i> foundation consists of natural earth, rock, or near-rock material stable enough to support the superimposed loads without lateral displacement or compaction entailing appreciable settlement or deformation. The term foundation also applies somewhat to a substructure unit
<b>foundation excavation</b>	the hole dug for a foundation
<b>foundation grillage</b>	a construction of layered steel, timber, or concrete members. All layers are alike. The members in each layer are parallel, producing a crib or grid-like effect. Grillage usually hold heavy concentrated loads. <i>See also</i> <b>floating foundation</b> and <b>grillage</b>
<b>foundation load</b>	the load imposed on a given foundation
<b>foundation pile or piled</b>	a wood, metal, or reinforced concrete pile used to reinforce a foundation to support superimposed loads
<b>foundation pit</b>	<i>see</i> <b>foundation excavation</b>
<b>foundation raft</b>	<i>see</i> <b>floating foundation</b>
<b>foundation seal</b>	a concrete mass placed underwater to close or seal a cofferdam against incoming water. <i>See also</i> <b>tremie</b>
<b>foundation stone</b>	a coarse stone that touches the foundation of a structure
<b>FP</b>	fixed point
<b>fps</b>	feet per second; foot per second
<b>frame</b>	a structure arranged and secured so that it will not be distorted by supporting loads and forces and physical pressures. Framing includes design and fabrication for the complete structure
<b>framed bent</b>	<i>see</i> <b>bent</b>
<b>framing</b>	<i>see</i> <b>frame</b>
<b>friction pile</b>	a pile that receives its support through friction resistance along the lateral surface of the pile
<b>friction roller</b>	a roller placed between members that reduces frictional resistance to translation movement to cause change in the relative positions of the members

<b>front-load bearing</b>	live-load bearings on the support pier of a bascule bridge
<b>frost heave</b>	the upward movement of and force exerted by soil due to alternate freezing and thawing of retained moisture
<b>frost line</b>	the depth to which soil may freeze
<b>ft</b>	foot; feet
<b>full-height abutment</b>	<i>see</i> <b>shoulder abutment</b>
<b>galvanic action</b>	the electrical current between two unlike metals
<b>gauge</b>	the distance between parallel lines (such as rails and rivet holes) or a measure of sheet metal or wire thickness
<b>girder</b>	a flexural member that is the main or primary support for the structure, which usually receives loads from floor beams and stringers. A girder can be any large beam, especially if built up
<b>girder bridge</b>	a bridge with two or more girders supporting a separate floor system of slab and floor beams and possibly stringers; a bridge using large, built-up steel beams, prestressed concrete beams, or concrete box girders
<b>girder span</b>	a span in which the major longitudinal supporting members are girders
<b>go-and-come allowance</b>	<i>see</i> <b>clearance</b>
<b>gothic arch</b>	an arch in which the intrados surface has two equal cylinder segments intersecting obtusely at the crown
<b>GP</b>	poorly graded gravels; a gravel-sand mixture with little or no fines
<b>GPM</b>	gallons per minute
<b>grade crossing</b>	an intersection of one railroad and one highway at a common grade or elevation; an intersection of two or more highways; an intersection of two railroads
<b>grade intersection</b>	the place where a horizontal and an inclined length of roadway or two inclined lengths meet in profile. The intersections are connected by a vertical curve to provide an easy transition from one to the other. The resulting profile is a sag or a summit, depending on whether it is concaved or convexed upward
<b>grade separation</b>	the use of a bridge structure and its approaches to confine portions of traffic to different elevations, thus dividing or separating the crossing movement. <i>See also</i> <b>overpass</b>
<b>gradient</b>	the rate at which the roadway or sidewalk surface inclines. It is commonly expressed as a percentage relation of horizontal to vertical dimensions
<b>gravity abutment</b>	a heavy abutment that resists the horizontal earth pressure with its own dead weight
<b>gravity wall</b>	a brick, stone, or concrete wall that is stable against sliding and rotation (overturning) on its foundation or on any horizontal plane by virtue of its shape and weight

---

<b>grillage</b>	a frame that is rigidly connected and built into a masonry bridge seat, a skewback, or another substructure support to ensure satisfactory load distribution; a platform-like construction or assemblage used to ensure distribution of loads on unconsolidated soil material. <i>See also</i> <b>foundation grillage</b>
<b>grout</b>	a mortar with enough water content to make it a free-flowing mass. Grout is used to fill the spaces between stones or fragments (spalls) in the backing part of stone masonry, to fix anchor bolts, or to fill cored spaces in castings, masonry, or other spaces where water may accumulate
<b>GTA</b>	graphic training aid
<b>guard fence</b>	<i>see</i> <b>railing</b>
<b>guard pier</b>	a concrete or stone-masonry fender that protects the supporting center pier of the swing span from injury. The pier may or may not be equipped with a rest pier upon which the swing span in its open position may be latched
<b>guard rail</b>	<i>see</i> <b>railing</b>
<b>guide</b>	a member that holds a moving part in position and directs its movement
<b>guide roller</b>	a fixed roller that serves as a friction roller and guide for a member
<b>gusset</b>	a plate serving to connect or unite the elements of a member or the members of a structure and to hold them in correct alignment or position at a joint. A plate may function either as a gusset and splice plate or as a gusset and stay plate. <i>See also</i> <b>stay plate</b>
<b>gutter</b>	<i>see</i> <b>drain</b>
<b>gutter grating</b>	a perforated or barred cover that is placed on an inlet to a drain to prevent the entrance of debris
<b>guy</b>	a cable, chain, rod, or rope that checks and controls movement or holds a structure or part in fixed alignment or position
<b>GW</b>	well-graded gravels; a gravel-sand mixture with 5 percent or less of fines
<b>hacked anchor bolt</b>	<i>see</i> <b>swedged anchor bolt</b>
<b>hand-drawn bridge</b>	<i>see</i> <b>hand-operated span</b>
<b>hand hole</b>	holes provided in cover plates of built-up box sections to permit access for maintenance and construction
<b>hand-operated span</b>	a span that is operated manually by applying force on a capstan, winch, windlass, or wheel. Such swing spans are called a <i>hand-drawn bridge</i> , a <i>hand-swing bridge</i> , or a <i>lever-swing bridge</i>
<b>handrail</b>	railing presenting a latticed, a barred, a balustered, or another open-web construction. <i>See also</i> <b>railing</b>
<b>hand-swing bridge</b>	<i>see</i> <b>hand-operated span</b>
<b>hanger</b>	a tension element or member that suspends or supports an attached member such as the floor system of a truss, arch, or suspension span. Suspension bridges use wire cable (termed <i>suspender</i> ). <i>See also</i> <b>suspender</b>

<b>haunch</b>	a beam or column deepening, usually deepest at the support and vanishing at or toward the center. The curve of the lower flange or surface may be circular, elliptic, parabolic, straight, or stepped
<b>H-beam</b>	a rolled-steel bearing pile with an H-shaped cross section
<b>head</b>	a measure of water pressure expressed in terms of an equivalent weight or pressure exerted by a column of water. The height of the equivalent column of water is the head
<b>headwater</b>	the depth of water at the inlet end of a pipe, culvert, or bridge waterway. <i>See also</i> <b>tailwater</b>
<b>headway</b>	<i>see</i> <b>clear headway</b>
<b>heat treatment</b>	various operations (such as tempering, quenching, and annealing) that use heating and cooling to impart specific properties to metals
<b>heel of span</b>	the rotation end of a bascule span
<b>heel stay</b>	<i>see</i> <b>shear lock</b>
<b>hem</b>	hemlock
<b>hemispherical bearing</b>	a bearing that uses the ball-and-socket principle to allow revolution in any direction
<b>hinged joint</b>	a joint constructed to permit rotation
<b>hip joint</b>	the juncture of the inclined end post with the end top-chord member of a truss. In a swing span, the juncture of the inclined end post next to the span center with the combined top chord and the connecting tie member between the arms is an <i>interior</i> hip joint or hip of truss
<b>hip of truss</b>	<i>see</i> <b>hip joint</b>
<b>hook bolt</b>	a bolt with its head end bent at or nearly at a right angle to its body portion that acts as a clamp; a bolt with a forged hook at one end used like an eyebolt. <i>See also</i> <b>eyebolt</b>
<b>hooked anchor bolt</b>	an anchor bolt bent to form a hook-like anchorage
<b>horizontal curve</b>	a curve in the plan location defining the alignment
<b>Howe truss</b>	a parallel-chord truss in which the web system is composed of vertical (tension) rods at the panel points with an x-pattern of diagonals. Although Howe trusses are usually used in wooden bridges, metal bridges also use them, but to a limited extent because using metal in compression members is uneconomical
<b>HP-shaped beams</b>	bearing piles
<b>HQ</b>	headquarters
<b>hydrolysis</b>	a chemical process of decomposition in the presence of water elements
<b>hydroplaning</b>	loss of contact between a tire and a deck surface when the tire planes or glides on a film of water covering the deck
<b>hydrostatic</b>	of or relating to fluids at rest or the forces exerted by such fluids
<b>ice guard</b>	<i>see</i> <b>fender</b>
<b>impact load</b>	a load allowance or increment intended to provide for the dynamic effect of nonstatic loads

---

<b>in</b>	inch(es)
<b>indeterminate bridge</b>	a bridge in which forces in the members cannot be determined by static equations alone
<b>indeterminate stress</b>	a stress induced by incorporating a redundant member in a truss or by an additional reaction in a beam, making stress distributions indeterminate. In redundant beams or trusses, stress distribution depends on the relative stiffnesses or areas of the members
<b>inelastic compression</b>	compression beyond the yield point
<b>inspection ladder</b>	special devices or appliances that make a safe and efficient means for making inspections and tests. They are rigidly fixed on the structure to prevent displacement. However, some structures are adapted for movable platform devices. <i>See also</i> <b>catwalk</b>
<b>integral abutment</b>	a small abutment cast monolithically with the end diaphragm of the deck
<b>intercepting ditch</b>	a ditch constructed to prevent surface water from flowing in contact with the toe of an embankment or a causeway or down the slope of a cut
<b>intergranular pressure</b>	pressure between soil grains
<b>intermittent weld</b>	a noncontinuous weld composed of a series of short welds and intervening spaces with fixed length and spacing
<b>intrados</b>	the curve defining the interior surface of the arch
<b>IPS</b>	improved plow steel
<b>ISBN</b>	International Standard Book Number
<b>jack stringer</b>	the outermost stringer supporting the bridge floor in a panel or bay, commonly weaker than a main stringer
<b>joint</b>	the space between individual stones in stone masonry; the division or end of continuity in concrete; a point at which members of a truss or frame are connected
<b>Jul</b>	July
<b>key bolt</b>	<i>see</i> <b>cotter bolt</b>
<b>keystone</b>	a stone of the crown string course of an arch; the final stone placed, closing the arch; or symmetrically shaped, wedge-like stone in a head-ring course at the crown of the arch, extending beyond the extradosal and intradosal limits of the voussoirs of adjoining string courses
<b>king post</b>	the post member in a king-post truss or in the king-post portion of any other type of truss
<b>king-post truss</b>	a truss adapted to either wooden or metal bridges. The king-post truss has two triangular panels with a common vertical post and a beam or chord extending the full truss. It is the simplest truss
<b>king rod</b>	<i>see</i> <b>king post</b>
<b>kip-feet</b>	a unit of measure used to express moment equal to 1,000 pounds of force acting over a one-foot-long moment arm

<b>kips</b>	a unit of weight (equal to 1,000 pounds) that is used to express deadweight loads
<b>km</b>	kilometer(s)
<b>knee brace</b>	a short member that engages two other members, which are joined to form a right angle or a near-right angle, at its ends. The brace strengthens the connecting joint and makes it more rigid
<b>knee wall</b>	a return of the abutment back wall at its ends to enclose the bridge seat on three sides. The returned ends hide the bridge seat, beam ends, and bearings and may retain a portion of the bridge approach material
<b>knuckle</b>	part of the anchorage of a main suspension member that permits the anchorage chain-free, longitudinal movement in changing direction and provides for elastic deformations caused by temperature changes and the pull of the suspension member
<b>kpf</b>	kip(s) per foot
<b>ksf</b>	kip(s) per square foot
<b>ksi</b>	kip(s) per square inch
<b>K-truss</b>	a truss with a web system in which the diagonal members intersect the vertical members at or near midheight (K-shaped)
<b>L-abutment</b>	a cantilever abutment with the stem flush with the toe of the footing, forming an L in cross section
<b>lacing</b>	<i>see lattice</i>
<b>ladle analysis</b>	the analysis or test of a spoon sample of ferrous metals taken during each melt of the pouring (teeming) operation. It is the analysis of drillings taken from the finished material and a check determination of the results secured from the ingots made at the furnace
<b>lagging</b>	<i>see forms</i>
<b>lam</b>	laminated; lamination
<b>laminated timber</b>	timber planks glued together to form a larger member. Laminated timber is used for frames, arches, beams, and columns
<b>lapidification</b>	<i>see consolidated soil foundation</i>
<b>lap joint</b>	a joint in which a splice is secured by fixing two elements or members in a position where they project on or overlap each other
<b>latch</b>	the device provided at one or both ends of a swing span to hold it in its correct alignment when closed and in readiness for the end wedges or lifts
<b>latch block</b>	<i>see latch</i>
<b>latch lever</b>	a hand-operated lever attached by a rod, cable, or chain to the latching device of a movable span and used to engage and release the latch



<b>lattice or latticing</b>	an assemblage of single or combined bars, channels, or angles fixed in inclined positions on two or more elements of a member to secure the elements in position and ensure their combined action. When the bars incline in opposite directions and connect at their intermediate length intersections, the assemblage becomes a <i>double lattice</i>
<b>lattice truss</b>	a truss with inclined web members. It has two or more web systems composed entirely of diagonal members at any interval and crossing each other without reference to vertical members. Any vertical members act as web stiffeners and may connect vertical brace frames to the girders
<b>lb</b>	pound(s)
<b>lb/ft</b>	pound(s) per foot; pound(s) per feet
<b>leaf</b>	the portion of a bascule bridge that forms part or all of the span
<b>ledger course</b>	a layer in masonry or concrete construction with a projection beyond the plane of superimposed on its top bed
<b>ledge rock</b>	<i>see</i> <b>bedrock</b>
<b>LEE</b>	labor and equipment estimates
<b>lenticular truss</b>	a truss in which the polygonal chords curve in opposite directions, while their ends meet at a common joint. This is very similar to a parabolic arc. In through spans, the floor system is suspended from the joints of the bottom chord and the end posts are vertical
<b>lever-swing bridge</b>	<i>see</i> <b>hand-operated span</b>
<b>lift span</b>	a superstructure span revolving or lifting vertically to allow obstruction-free navigation. <i>See also</i> <b>movable bridge</b>
<b>lifting girder</b>	a girder or girder-like member engaging the trusses or girders of the attached vertical-lift span
<b>link and roller</b>	an adjustable, hinged, strut-like link fitted with a roller at its bottom end. It is supported on a shoe plate or pedestal and operated by a thrust strut, which forces it into and withdraws it from a vertical position. When installed on the outer ends of the girders or trusses of a swing span, link and rollers lift the span enough to remove the camber or allow the span to droop and free the arms to act as simple spans. When the links are withdrawn to a fixed (inclined) position, the span can be opened
<b>lintel bridge</b>	a bridge with one or a series of spans composed of slabs of stone or reinforced concrete, spanning the interval(s) between its substructure elements
<b>lintel stone</b>	a stone used to support a wall over an opening
<b>live load</b>	a dynamic load (such as traffic) that is applied to a structure suddenly or that is accompanied by vibration, oscillation, or other conditions that affects its intensity

<b>live-load bearing</b>	a class of bearings or supports installed on movable swing and bascule spans. They are engaged when the bridge is in the closed position, taking the load off the trunnions and center pivot and preventing the outer end of the lift span from hammering on the rest pier under live load
<b>loading girder</b>	girders of a center-bearing swing span located above the pivot pier. Loading girders concentrate the superimposed load on the pivot
<b>LOC</b>	lines of communication
<b>lock device</b>	any of various devices, including incidental levers, shafts, and gears, used to lock bascules, vertical lifts, or swing spans in position
<b>locking mechanism</b>	<i>see</i> <b>lock device</b>
<b>lower track</b>	<i>see</i> <b>roller track</b>
<b>L-shaped beam</b>	a beam comprised of two legs that forms an L
<b>m</b>	meter(s)
<b>MANSCEN</b>	Maneuver Support Center
<b>margin</b>	<i>see</i> <b>tolerance</b>
<b>masonry</b>	stone, brick, or concrete structures (such as abutments, piers, retaining walls, and arches)
<b>masonry plate</b>	a steel plate or plate-shaped member attached on a substructure part to support the rocker, shoe, or pedestal of a beam, girder, or truss span and to distribute the load to the masonry beneath
<b>mattress</b>	a mat-like protective covering made of brush and poles (commonly willow) compacted by wire or other lashings and ties. Mattresses are placed on water beds, banks, or shores to prevent erosion and scour
<b>max</b>	maximum
<b>meander</b>	a slow-flowing stream's serpentine curvature in a floodplain
<b>mechanical bond</b>	the bond resulting from surface irregularities from manufacturing operations. The difference in round-bar reinforcement between the force required to produce initial slip and the ultimate, producing failure. <i>Deformed bars</i> use this mechanical bond with the surface bond
<b>member</b>	any individual piece of an assembled frame or structure
<b>MGB</b>	medium-girder bridge
<b>mi</b>	mile(s)
<b>milled</b>	a careful grinding of an edge or surface in steel fabrication to ensure good bearing or fit
<b>min</b>	minimum
<b>MLC</b>	military load classification
<b>mortar</b>	a mixture of cementing material with fine aggregate and water. Mortar is used to bed and bind quarried stones, bricks, or other solid materials together or to produce a plastic coating on such constructions. This coating is also termed <i>floated</i> or <i>surface face</i> , <i>mortar coat</i> , <i>mortar finish</i> , or <i>parapet</i>

---

<b>mortar coat</b>	<i>see</i> <b>mortar</b>
<b>mortar finish</b>	<i>see</i> <b>mortar</b>
<b>MOS</b>	military occupational specialty
<b>movable bridge</b>	any bridge with one or more spans that can be raised, turned, lifted, or slid from their normal position to allow passage of navigation. <i>See also</i> <b>draw span</b> and <b>lift span</b>
<b>movable span</b>	a superstructure intended to be swung or lifted to provide an unobstructed waterway space for waterborne traffic
<b>mph</b>	mile(s) per hour
<b>MSR</b>	main supply route
<b>mud sill</b>	a piece of timber or a unit of two or more timbers placed on a soil foundation to support a single column, a framed trestle bent, and so forth. A load distribution piece aligned with and placed directly beneath the sill piece of a framed bent is a <i>subsill</i> , although it may act as a mud sill
<b>multicentered arch</b>	an arch in which the intrados surface is outlined by two or more arcs having different radii by intersecting tangentially and disposed symmetrically
<b>N</b>	north
<b>N/A</b>	not applicable
<b>na</b>	neutral axis
<b>NATO</b>	North Atlantic Treaty Organization
<b>natural foundation</b>	<i>see</i> <b>foundation</b>
<b>natural slope</b>	<i>see</i> <b>angle of repose</b>
<b>NDS</b>	national design specification
<b>neat line</b>	the general alignment or position of a face or another surface exclusive or regardless of projections
<b>neat surface</b>	<i>see</i> <b>neat line</b>
<b>No.</b>	number(s)
<b>normal roadway cross section</b>	the usual cross section of a roadway along straight stretches of a road
<b>nose</b>	a projection acting as a cutwater on the upstream end of a pier. <i>See also</i> <b>starling</b>
<b>notched anchor bolt</b>	<i>see</i> <b>swedged anchor bolt</b>
<b>notch effect</b>	stress concentration caused by an abrupt discontinuity or change in a section. It can markedly affect a member's fatigue strength
<b>N-truss</b>	<i>see</i> <b>Pratt truss</b>
<b>OCONUS</b>	outside continental United States
<b>OH</b>	organic silt; organic silt clay of low plasticity

<b>open-spandrel arch</b>	an arch with unfilled spandrel walls. The arch ring receives its superimposed loads through these walls and, if necessary, through interior spandrel walls, tie or transverse walls, or interior columns. An open-spandrel arch is a structure in which bays or panels with arches, lintel spans, or other construction supporting the deck replace the spandrel walls. In turn, a cross wall or columns resting on the arch ring support these bays or panels
<b>open-spandrel, ribbed arch</b>	a structure in which two or more comparatively narrow arch rings function in the place of an arch barrel. Arch rib struts located at intervals along the length of the rings secure the ribs rigidly in position. The arch rings support a column-type, open-spandrel construction sustaining the floor system and its loads
<b>operator's house</b>	the building containing the power plant, operating machinery, and devices required to open and close a bridge span. Also referred to as an operator's cabin
<b>outer bearing</b>	those live-load bearings placed on swing-span and bascule-rest piers
<b>overpass</b>	a separation of grades in which elevated traffic structures are overpasses and lowered ones are underpasses. <i>See also</i> <b>grade separation</b>
<b>packing ring</b>	<i>see</i> <b>spreader</b>
<b>paddle boards</b>	striped, paddle-shaped signs or boards placed on the roadside in front of a narrow bridge as a warning
<b>panel</b>	the portion of a truss span located between adjacent web and chord-member intersection points and applied to intersections on the bottom chord. A truss panel divided into two equal or unequal parts by an intermediate web member (such as a subdiagonal or a hanger) forms <i>subpanels</i>
<b>panel point</b>	the point where primary web and chord members of a truss intersect
<b>para</b>	paragraph(s)
<b>parabolic arch</b>	an arch in which the intrados's surface is a segment of a symmetrical parabolic surface (suited to concrete arches)
<b>parabolic arched truss</b>	<i>see</i> <b>parabolic truss</b>
<b>parabolic truss</b>	a polygonal truss with its top chord and end-post vertices similar to the arc of a parabola, its bottom chord straight, and its web system triangular or quadrangular
<b>parapet</b>	a wall-like brick, stone, or reinforced concrete member on the retaining wall of an approach cut, embankment, or causeway or along the outer edge of the roadway or sidewalk of a bridge to protect vehicular and pedestrian traffic. Although similar to a balustrade, a parapet is usually a block barrier with no openings in the body portion. <i>See also</i> <b>mortar</b>
<b>parent metal</b>	<i>see</i> <b>base metal</b>
<b>Parker truss</b>	an adaptation of the Pratt truss in which the top chord is polygonal in shape. <i>See also</i> <b>Pratt truss</b>
<b>PC</b>	personal computer

---

<b>pedestal</b>	a cast or built-up metal member or assemblage that transmits loads from one part of a structure to another. A pedestal may also provide for longitudinal, transverse, or revolutional movements; block-like stone, concrete, or brick constructions on the bridge seat of an abutment or pier that provide support for the beams. <i>See also</i> <b>expansion shoe</b>
<b>pedestrian bridge</b>	<i>see</i> <b>footbridge</b>
<b>peen</b>	to draw, bend, or flatten by or as if by hammering with a peen
<b>penetration</b>	the depth to which a pile tip is driven into the ground, surface wood is permeated by creosote oil, or the surface of structure metal is fused and coalesced with metal to produce a weld joint
<b>perched abutment</b>	<i>see</i> <b>stub abutment</b>
<b>pier</b>	a shaft or block-like structure that supports the ends of the spans of a multispan superstructure midway between its abutments. Several types apply to bridge construction. Some are classified by functional distinctions (anchor, pivot, and rest piers), and others are classified by shape (cylinder, pedestal, pile, and rigid-frame piers)
<b>pier cap</b>	the top part of a pier. On rigid-frame piers, the pier cap is the beam across the column tops. On hammerhead and T-piers, the pier cap is a continuous beam. <i>See also</i> <b>cap</b> and <b>pile cap</b>
<b>pilaster</b>	a column-like projection on a face surface used to relieve the blankness of a plane surface
<b>pile</b>	a rod or shaft-like linear member driven into the earth. Piles carry structure loads through weak soil to that soil capable of supporting them and support loads where scour may cause loss of earth support
<b>pile cap</b>	a concrete footing for a pier or an abutment supported on piles or the concrete below the pile tops when footing reinforcing steel is placed completely above the piles. <i>See also</i> <b>cap</b> and <b>pier cap</b>
<b>pile cut-off</b>	the part of a pile that has been removed or will be removed from its driven butt end to secure the desired elevation
<b>pile shoe</b>	a metal piece fixed on the point or penetration end of a pile to protect it during driving and to ease penetration of dense earth
<b>pile splice</b>	a means of joining one pile on the end of another to provide greater penetration length
<b>piling</b>	a number of piles used together to form a construction (such as a crib, cofferdam, or bulkhead)
<b>pin</b>	a cylindrical bar used to connect, hold in position, and transmit the stresses of members in a truss or framed joint. To restrain the pin against longitudinal movement, the pin ends are fitted with pin nuts, cotter bolts, or both. The pin ends may also be burred or fitted with cotters to prevent the nut from dislodging or coming loose
<b>pin-connected truss</b>	any truss in which pins connect the chord and web members at the truss joints
<b>pin-filler</b>	<i>see</i> <b>spreader</b>
<b>pinion</b>	the small driving gear on the power train of a movable bridge

<b>pinion bracket</b>	the frame supporting the turning pinion with its shaft and bearings on a swing-span drum girder or loading girder
<b>pin joint</b>	a joint in a truss or another frame in which the members are assembled on a cylindrical pin
<b>pin packing</b>	an arrangement of truss members on a pin at a pinned joint
<b>pin plate</b>	a metal sheet that is rigidly attached on the end of a member to secure a desired bearing, to develop and distribute the stress of the joint, and/or to secure additional strength and rigidity
<b>pintle</b>	a small steel pin or stud that engages the rocker in an expansion bearing, permitting rotation, transferring shear, and preventing translation
<b>pitch</b>	the longitudinal spacing between rivets, studs, bolts, holes, and so forth that are in a straight line
<b>plate girder</b>	an I-shaped beam made of a solid plate web with flange plates or angles bolted, riveted, or welded on its edges. Additional cover plates may be attached to the flanges to provide greater flange area. <i>See also</i> <b>built-up column</b>
<b>plate span</b>	<i>see</i> <b>girder span</b>
<b>platform</b>	<i>see</i> <b>inspection ladder</b>
<b>play allowance</b>	<i>see</i> <b>clearance</b>
<b>PLC</b>	provisional load classification
<b>plinth</b>	<i>see</i> <b>footing</b>
<b>plug weld</b>	a weld that connects two overlapping members by placing weld material in a hole or slot drilled in one of the overlapping members
<b>pointed arch</b>	<i>see</i> <b>gothic arch</b>
<b>pointing</b>	the operations involved in compacting mortar in the outer part of a joint and in troweling or otherwise treating its exposed surface to secure watertightness, desired architectural effect, or both
<b>polygonal truss</b>	any truss with an irregular (broken) straight top-chord alignment that forms with the end posts and with the bottom chord forming the perimeter of a polygon
<b>pontoon</b>	a boat or another floating structure used as one of the supports for a temporary bridge
<b>pontoon bridge</b>	a bridge with boats, scows, or pontoons fixed in position on the deck or floor to support vehicular and pedestrian traffic. A pontoon bridge may have a removable part to ease navigation. Modern floating bridges may have pontoons integrated with the deck. <i>See also</i> <b>portable bridge</b>
<b>pony truss</b>	a truss not high enough to permit an effective top-chord system of lateral bracing above the bridge floor
<b>pop-out</b>	conical fragment (about one inch in diameter) broken out of a concrete surface; shattered aggregate particles usually found at the bottom of a hole
<b>portable bridge</b>	a bridge that may be readily erected for a temporary communication/transport service, then disassembled and reused. <i>See also</i> <b>pontoon bridge</b>

<b>portal</b>	the clear, unobstructed entry of a through bridge; the chord bracing that fixes the top vertical clearance. The portal of a skew bridge is a <i>skew portal</i>
<b>post</b>	<i>see</i> <b>column</b>
<b>posted</b>	a limiting dimension indicating a bridge cannot safely take larger dimensions or loads or higher speeds
<b>pot holes</b>	small, worn or disintegrated areas of a bridge floor or approach surface caused by vehicle wheels
<b>Pratt truss</b>	a truss with parallel chords and a web system of vertical posts with diagonal ties inclined from the bottom-chord panel points toward the ends of the truss except for the counters required in midlength panels. <i>See also</i> <b>Parker truss</b>
<b>prestressed bridge</b>	a bridge in which the main carrying members are prestressed concrete
<b>priming coat</b>	the first coat of paint applied to the metal or other material of a bridge. For metal structures, it is often applied in the shop and is termed the <i>shop coat</i>
<b>protection railing</b>	<i>see</i> <b>railing</b>
<b>psi</b>	pound(s) per square inch
<b>PSP</b>	pierced, steel plank
<b>QSTAG</b>	Quadripartite Standardization Agreement
<b>quarry face</b>	<i>see</i> <b>dimension stones</b>
<b>queen-post truss</b>	a parallel-chord truss adapted to either timber or metal bridges. The queen-post truss has three panels. One of the chords occupies only the length of the center panel. Unless center-panel diagonals are provided, this is a <i>trussed beam</i> . <i>See also</i> <b>trussed beam</b>
<b>rack</b>	a bar with teeth on one side to mesh with the gears of a pinion or worm. It is usually attached to the moving portion of a movable bridge
<b>radial rod</b>	a radially located tie rod connecting the roller circle of a rim-bearing swing span with the center pivot or center-bearing casting
<b>radial strut</b>	a radially located brace member of the drum construction of a rim-bearing wing span
<b>ragged anchor bolt</b>	an anchor bolt cut with a chisel to produce fin-like projections that hold the bolt in place
<b>railing</b>	a fence-like barrier or protection built within the roadway shoulder area to be a combined guide and guard for moving vehicular and pedestrian traffic and to prevent or hinder the accidental passage of such traffic beyond the berm line of the roadway
<b>rake</b>	the slope, batter, or inclination of the sides of an embankment or other earth construction or of a masonry surface. <i>See also</i> <b>batter</b>
<b>ramp</b>	an inclined traffic way leading from one elevation to another (such as an inclined, usually steep, approach to a bridge)
<b>random stone</b>	a quarried stone block of any dimension

<b>range of stress</b>	the algebraic difference between the minimum and maximum stresses in a member or any of its parts produced by a given condition of loading or by its actual service loading
<b>rebar</b>	a steel reinforcing bar placed in concrete to improve its tensile properties
<b>redundant member</b>	a member of a truss or frame necessary only to reduce the stress carried by the determinate structure, which would be stable without it
<b>reentrant corner</b>	a corner with more than 180 degrees of open space
<b>reflection</b>	<i>see</i> <b>cracking</b>
<b>reinforced concrete beam</b>	a beam in which the metal reinforcement carries the tensile stresses. The concrete takes compression only, with some shear. It is commonly rectangular or T-shaped, with its depth dimension greater than its stem width
<b>reinforced concrete cantilever wall</b>	a wall with a base section integral with its stem constructed approximately at a right angle, giving its cross section an L- or an inverted T-shape. The stem portion resists the forces producing overturning by acting as a cantilever beam
<b>reinforcing bar</b>	a steel bar, with a plain or deformed surface, that bonds to the concrete and supplies tensile strength to it
<b>retaining wall</b>	a structure designed to restrain and hold back a mass of earth
<b>retractile drawbridge</b>	a bridge with a superstructure that can move horizontally (either longitudinally or diagonally) from a closed to an open position. The part acting in cantilever is counterweighted by that supported upon rollers
<b>rigid-frame bridge</b>	a bridge with rigid or moment-resistant connections between deck slabs or beams and the substructure walls or columns that produce an integral elastic structure. The structure may be steel or concrete
<b>rim girder</b>	<i>see</i> <b>drum girder</b>
<b>rim plate</b>	a toothed or plain segmental rim on a rolling-lift bridge
<b>ringbolt</b>	a ringbolt is an eyebolt fitted with a ring for added articulation; <i>See also</i> <b>eyebolt</b>
<b>ring stone</b>	<i>see</i> <b>voussoir</b>
<b>riprap</b>	protective covering material (such as blocks, brickbats, or stones) deposited on water beds, banks, and shores to prevent erosion and scour
<b>rise of an arch</b>	the vertical distance for a symmetrical arch (from the chord through its springing lines to the intrados at its crown). For an unsymmetrical arch, the rise is measured from the springing lines to the crown
<b>riveted joint</b>	a joint in which rivets or bolts unite the assembled elements and members. Proper distribution of rivets or bolts allows the joint to develop its various parts with relation to their stresses and purposes. Bolted and riveted joints employ different allowable unit stresses



<b>roadway</b>	the portion of the deck surface of a bridge or of an approach embankment, causeway, or cut intended for vehicular and pedestrian traffic
<b>roadway berm</b>	<i>see</i> <b>berm</b>
<b>roadway shoulder</b>	that part of the top surface of an approach embankment, causeway, or cut immediately adjoining the roadway that accommodates stopped vehicles in emergencies and laterally supports base and surface courses
<b>rocker and camshaft</b>	an adjustable mechanism consisting of a rocker bearing and a camshaft. Properly mounted and geared, the mechanism reacts on a fixed shoe plate or pedestal, rotating to produce a vertical lifting action
<b>rocker bearing</b>	a cylindrical, sector-shaped member attached to the expansion end of a girder or truss. The rocker bearing has line-bearing contact with the masonry plate or pedestal. This wheel-like translation allows longitudinal movement caused by temperature changes and superimposed loads
<b>rocker bent</b>	a metal, reinforced concrete, or timber bent that is hinged or joined at one or both ends to allow longitudinal movement caused by temperature changes and superimposed loads
<b>rock face</b>	<i>see</i> <b>dimension stones</b>
<b>roller</b>	a steel cylinder in a roller nest or any other rolling device or part; one of the wheel-like elements forming the roller circle of a rim-bearing swing span
<b>roller bearing</b>	one or more rollers housed to permit movement of structural parts
<b>roller nest</b>	a group of rollers (usually assembled in a frame or box) forming part of the movable end of a girder or truss and located between the masonry plate and shoe or pedestal. Roller nests ease longitudinal movement caused by temperature changes and superimposed loads
<b>roller track</b>	the circular track on which the drum rollers of a rim-bearing swing span travel
<b>rolling-lift bridge</b>	a bascule bridge that rolls backward and forward on supporting girders
<b>RR</b>	railroad
<b>rubble</b>	irregularly shaped pieces of stone obtained from a quarry. Rubble may vary from small, usable pieces to large boulders and fragments requiring mechanical equipment for handling. Stones that are ready to use in rubble masonry are <i>worked</i> or <i>dressed rubble</i>
<b>run</b>	<i>see</i> <b>bead</b>
<b>runoff</b>	the part of precipitation on a drainage (catchment) area that is discharged quickly and therefore affects the design of that area of the bridge. The amount of runoff depends on the soil type and conditions, the amounts of rainfall or snow, and so forth
<b>saddle</b>	a member on the tower of a suspension bridge that supports the suspension cable or chain and allows horizontal movement caused by elastic deformations from temperature changes and service loads

<b>safe load</b>	the maximum load that a structure can hold. The maximum load is determined by the magnitude and distribution of the wheel, the axle, and so forth and is based on the physical condition of the structure and its previous use
<b>safety curb</b>	a narrow curb (between 9 and 24 inches wide) that serves as a refuge or walkway for pedestrians crossing a bridge
<b>safety factor</b>	a factor that engineers use to allow for the failure stress or stresses assumed to exist in a structure or a member. It provides a margin of error in the strength, rigidity, deformation, and endurance of a structure or its component parts to compensate for irregularities in structural materials and workmanship, uncertainties involved in mathematical analysis and stress distribution, service deterioration, and other unevaluated conditions
<b>sag</b>	a deformation of an entire span (or one of its members or parts) from its required position; the total deflection of the cable members of a suspension bridge
<b>sag ratio</b>	the relation between the sag and the span length
<b>sag rod</b>	a rod with threads and nuts at its ends that restrains a structure member from sagging due to its own weight or external forces
<b>sash brace</b>	the horizontal member in a tier of bracing attached to a timber or a reinforced concrete or metal trestle bent or tower to add rigidity to the structure
<b>sash stay</b>	<i>see</i> <b>sash brace</b>
<b>SBC</b>	soil bearing capacity
<b>SC</b>	clayey sands; sand-clay mixture
<b>scab</b>	a plank that is spiked or bolted over the joint between two members to hold them in correct adjustment and to strengthen the joint
<b>scour</b>	an erosion of a water-bed area that is caused by moving water; erosion that produces a deepening or widening of the water area
<b>scow</b>	a flat-bottomed floating vessel with a rectangular hull, sloping ends, and no means of propulsion; commonly used as a support in a temporary bridge
<b>screw jack and pedestal</b>	an adjustable mechanism consisting of a screw operated in a fixed nut and joined on the bottom with a pedestal-like bearing, permitting adjustment on a fixed-shoe plate or pedestal. Screw jacks and pedestals installed at each outermost end of the girders or trusses of a swing span lift them to allow the camber or droop to remove the swing span and free the arms to act as simple spans
<b>scupper</b>	an opening in a bridge floor (commonly located next to the curb or wheel guard) to allow accumulated water to drain. On a reinforced concrete bridge, the scupper may be in the curb-face surface
<b>scupper block</b>	one of the short, wooden pieces fixed between the planks of a bridge floor and the bottom side of the wheel guard to provide scuppers
<b>seam weld</b>	a weld that joins the edges of two elements of a member or of two members placed in contact. This weld forms a continuous surface and prevents infiltration of moisture between the parts. This weld is not a stress-carrying weld

<b>seat angle</b>	a steel section that is attached to the side of a column girder or another member to provide support for a connecting member either temporarily during its erection or permanently
<b>segmental arch</b>	an arch in which the intrados surface is less than half the surface of a cylinder or cylindroid. Any right section that shows a parabolic curvature may include a segmental arch
<b>segmental girder</b>	a girder that uses a curved bottom flange and tread coatings to join the bridge span with the track girder on a movable bridge. <i>See also track girder</i>
<b>segmental rim</b>	the curved rim or circular segment of a rolling lift bridge
<b>segmental roller</b>	a roller with two circular segments that are integrally joined by a web-like portion
<b>seizing</b>	a wrapping of wire or other material that is applied on suspension-bridge cables to hold the individual wires in satisfactory contact condition
<b>semistub abutment</b>	a cantilever abutment that is found part way up the slope between a shoulder abutment and a stub abutment and is intermediate in size
<b>shafts</b>	pieces that are used in movable structures and that carry torsion stresses
<b>shear lock</b>	the mechanism at the heel of a bascule span that engages and holds the leaves closed and prevents rotation
<b>sheave</b>	a wheel with one or more grooves in its face surface
<b>sheave hood</b>	a protective covering that is placed above a sheave to prevent accumulations of moisture, sleet, and ice on the sheave face
<b>sheet girder</b>	a girder or girder-like member that supports the operating-cable sheaves at the top of a tower on a vertical-lift bridge
<b>sheet pile</b>	a timber, reinforced concrete, or rolled-steel pile used in bulkheads, cofferdams, and cribs to retain the earth and to prevent the inflow of water, liquid mud, and sand
<b>sheet pile cofferdam</b>	a wall-like, watertight barrier of driven timber or metal sheet piling. This dam is adapted to construction in still or slow-flowing, shallow water. Depositing earth material against the exterior side will sometimes makes the dam more watertight
<b>sheet piling</b>	a number of sheet piles placed together to form a crib, cofferdam, bulkhead, and so forth
<b>shelf angle</b>	<i>see seat angle</i>
<b>shim</b>	a comparatively thin piece of wood, stone, or metal that is inserted between two elements, pieces, or members to fix their relative position and/or to transmit bearing stress
<b>shoe</b>	a pedestal-shaped member at the end of a plate girder or truss that transmits and distributes its loads to a supporting area or member. A shoe may be a cast or a built-up member. <i>See also expansion shoe</i>
<b>shoe plate</b>	the base plate or plate-like part of a shoe that may take bearing directly on a masonry plate or an intervening expansion device

<b>shop coat</b>	<i>see</i> <b>priming coat</b>
<b>shore</b>	a strut or prop that is placed in a horizontal, inclined, or vertical position against or beneath a structure or a part of the structure to restrain movement
<b>shoulder abutment</b>	a cantilever abutment that extends from the grade line of the road below to that of the road overhead. It is usually set just off the shoulder
<b>shoulder area</b>	<i>see</i> <b>roadway shoulder</b>
<b>shuttering</b>	<i>see</i> <b>forms</b>
<b>side-hill cut</b>	<i>see</i> <b>cut</b>
<b>sidewalk</b>	the part of the bridge floor serving pedestrian traffic only and commonly elevated above the vehicle area for the safety and convenience of its users
<b>sidewalk bracket</b>	a triangular frame or cantilever beam attached to and projecting from the outside of a girder, truss, or bent to serve as a support for the sidewalk stringers, floor, and railing or parapet
<b>sill</b>	the base piece or member of a viaduct or trestle bent that distributes column loads directly on the foundation or on mud sills embedded in the foundation soil transversely to the alignment of the bent
<b>sill piece</b>	<i>see</i> <b>sill</b>
<b>silt</b>	very fine siliceous or other hard and durable material derived from its mother rock through attrition or other mechanical action rather than chemical decomposition
<b>simple span</b>	a superstructure span with a single unrestrained bearing or support at each end. This span is unaffected by stress transmission to or from an adjacent span or structure
<b>sin</b>	sine
<b>skew</b>	<i>see</i> <b>skew angle</b>
<b>skew angle</b>	the acute angle subtended by a line that is normal to the longitudinal axis of the structure and a line that is parallel to or coinciding with the alignment of its end as applied to oblique bridges
<b>skewback</b>	the course of stones in an abutment or pier that is located at the extremity of an arch and has inclined or battered beds as required to transmit the stresses of the arch; a casting or combination of castings or a built-up member designed to function as a skewback
<b>skewback pedestal</b>	<i>see</i> <b>skewback shoe</b>
<b>skewback shoe</b>	the hinged shoe or pedestal member that transmits the thrust of a trussed arch or plate-girder arch to an abutment or pier skewback or cushion course
<b>skew portal</b>	<i>see</i> <b>portal</b>
<b>slab</b>	a thick plate (usually of reinforced concrete) that supports loads by flexure and is usually treated as a widened beam

---

<b>slab bridge</b>	a bridge with a superstructure that is composed of a reinforced concrete slab that is either singular, constructed in place, or a series of narrow, precast slabs. This slab is parallel with the roadway alignment and spans the space between the supporting abutments or other substructure parts
<b>slag inclusion</b>	small particles of metal that are trapped inside a weld during the fusion process
<b>sleeve nut</b>	a device used to connect the elements of an adjustable rod or bar member. The sleeve nut is a forging with an elongated, nut-shaped body that has right- and left-hand threads in its end portions, permitting wrench adjustments or desired member tension
<b>slenderness ratio</b>	the measure of a member's stiffness, which is expressed as the length of the member divided by its radius of gyration
<b>slice plate</b>	<i>see gusset</i>
<b>slope</b>	the inclined surface of an excavated cut or an embankment
<b>slope pavement</b>	a thin surfacing of material deposited on the sloped surface of an approach cut, embankment, or causeway to prevent its disintegration by rain, wind, or other erosive action
<b>slope protection</b>	<i>see slope pavement</i>
<b>slot weld</b>	<i>see plug weld</i>
<b>SM</b>	silty sands; a sand-silt mixture
<b>soffit</b>	<i>see intrados</i>
<b>soldier beam</b>	a steel pile that is driven into the earth (with its butt end projecting) and used as a cantilever beam to support a plank-style retaining wall
<b>sole plate</b>	a plate that is bolted, riveted, or welded on the bottom flange of a rolled beam, plate girder, or truss to take direct bearing on a roller nest, bearing pedestal, or masonry plate. The plate distributes the reaction of the bearing to the beam, girder, or truss member and may act as a combined sole and masonry plate at the fixed end of a beam, a girder, or a truss
<b>SP</b>	poorly graded sands; a gravelly sand mixture with 5 percent or less of fines
<b>spalls</b>	a circular or oval depression in concrete that is caused by a separation of the surface concrete, revealing a fracture that is parallel with or slightly inclined to the surface; pieces of spalled concrete
<b>span</b>	the distance (center to center) of the end bearings or the distance between the lines of action of the reactions; the unobstructed space or distance between the faces of the substructure elements; the complete superstructure of a single-span bridge or a corresponding integral part or unit of a multiple-span structure
<b>spandrel</b>	the space bounded by the arch extrados, substructure abutments and/or piers, and the roadway surface or another fixed-elevation limit
<b>spandrel-arch structure</b>	<i>see face wall</i>

<b>spandrel column</b>	a column that is superimposed on the ring or a rib of an arch span and serving as a support for the deck construction of an open-spandrel arch
<b>spandrel fill</b>	the filling material placed in the spandrel space of an arch
<b>spandrel tie wall</b>	one of the walls built at intervals above the arch ring to tie together and reinforce the spandrel walls; any wall serving as a restraining member to prevent bulging and distortion of two other connected walls. <i>See also</i> <b>diaphragm wall</b>
<b>spandrel wall</b>	a wall that is built on an arch as a retaining wall for the spandrel fill and the roadway in a spandrel-filled arch or to support the floor system and its loads when the spandrel is not filled. Wide structures with unfilled spandrels may have one or more interior walls to provide a cellular construction when combined with tie walls
<b>specifications</b>	a detailed construction plan, including material quality and handling, load conditions and application, stress, design, and construction procedures
<b>spider</b>	the collar-like plate that connects a spider frame to a pivot
<b>spider frame</b>	the assemblage of struts, radial rods, spacer rings, and roller-adjusting devices holding the conical roller ring of a rim-bearing or a combined rim- and center-bearing swing span to the pivot
<b>spider rod</b>	<i>see</i> <b>radial rod</b>
<b>spill-through abutment</b>	two or more columns supporting A-grade beams. This abutment retains the approach embankment only partly, since the embankment's sloped front and side portions extend with their normal slope to envelop the columns
<b>splay saddle</b>	a member at the anchorage ends of suspension-bridge cables that permits the wires or strands to spread for connection to the anchorage
<b>splice</b>	the joining or uniting of elements or members of a structure to provide the desired conditions for transmitting stress and developing rigidity and strength to fulfill service requirements in design. All the parts used to unite elements of a member or members of a structure
<b>splice joint</b>	a joint in which the elements of a member or the members of a structure are joined by a splice plate or by a piece securing a required amount of strength and stability
<b>spreader</b>	a cast or fabricated piece used to hold angles, beams, channels, or fabricated parts in place to function as parts of a member or structure; a ring-like or sleeve-like piece placed on a pin to hold eyebars or other members in the correct position
<b>springing line</b>	the line in the face surface of an abutment or pier at which the intrados of an arch originates
<b>spur dike</b>	a projecting construction that is placed downstream and/or upstream and adjacent to a U- or T-shaped, blocked, or arched abutment to secure a gradual contraction of the stream's width and to induce a free, even flow of water adjacent to and beneath a bridge. Spur dikes may be constructed as an extension of the wing wall or as a winged abutment

<b>sq ft</b>	square feet; square foot
<b>sq in</b>	square inch(es)
<b>S-shaped beam</b>	the American-standard beam
<b>sta</b>	station
<b>STANAG</b>	Standardization Agreement
<b>starling</b>	an extension at the upstream end or at both ends of a pier that is built with battered surfaces, forming a cutwater to divide and deflect waters and floating debris. When on the downstream end, the starling functions to reduce crosscurrents and swirl and eddy actions that produce sand, silt, and debris deposits
<b>statics</b>	the branch of physical science concerned with bodies, static or at rest, upon which balanced forces act
<b>stay-in-place forms</b>	a prefabricated, metal, concrete-deck form that will remain in place after the concrete has set
<b>stay plate</b>	a plate that is placed at or near the end of a latticed side or the web of a compression or another member and at intermediate locations where connections interrupt the continuity of the latticing. This plate serves to distribute lattice-bar stress to the elements of the member and adds stiffness and rigidity to joint assemblages. <i>See also batten plate and gusset</i>
<b>steel box girder</b>	a steel beam or girder with a rectangular or trapezoidal cross section that is made of plates and angles or other structural shapes that are bolted, riveted, or welded together (a girder's only interior construction is stiffeners, diaphragms, or other secondary bracing parts). Steel box girders are large, steel, multicell boxes with interior webs and composite in which the concrete slab forms the top side of the box
<b>stem</b>	the vertical wall of an abutment retaining wall or solid pier. <i>See also breast wall</i>
<b>stiffener</b>	an angle, a T, a plate, or another rolled section that is riveted, bolted, or welded on the web of a plate girder or another built-up member to transfer stress and prevent buckling or other deformation
<b>stiffening girder</b>	a girder or truss incorporated in a suspension bridge to act with a suspension cable or chain by restraining the deformations of the cable or chain and by distributing the irregularly distributed loads, thus resisting and controlling vertical oscillations of the floor system
<b>stiffening truss</b>	<i>see stiffening girder</i>
<b>stirrup</b>	a U-shaped rod, bar, or angle piece that is placed in concrete beams, slabs, and so forth to resist diagonal tension stresses
<b>stirrup bolt</b>	a U-shaped rod or bar (that is fitted at its ends with threads, nuts, and washers) that is used to support streamer or other timber pieces of wooden truss structures that are suspended from the bottom chord

<b>stone facing</b>	a stone or brick surface covering or sheath laid to imitate stone or brick masonry with a depth thickness equal to the width dimension of one stone or brick for stretchers and equal to the length dimension for headers
<b>stone veneer</b>	<i>see</i> <b>stone facing</b>
<b>straight abutment</b>	an abutment that has the stem and wings in the same plane or that has the stem included within a length of the retaining wall. In general, the stem wall is straight but will conform to the alignment of the retaining wall
<b>straight wing wall</b>	a wall in continuation of the breast wall of the abutment
<b>strain</b>	the distortion of a body caused by one or more external forces and measured in units of length. In common use, strain is the proportional relation of the amount of distortion divided by the original length
<b>stream flow</b>	the water discharge that occurs in a natural channel. A more general term than runoff, stream flow may be applied to discharge whether or not it is affected by diversion or regulation
<b>stress</b>	resistance of a body to strain when in a solid or plastic state and which acts in an unconfined condition
<b>stress sheet</b>	a drawing that shows a structure in skeletal form and clarifies the general makeup, major dimensions, and the arrangement and composition of its integral parts. The drawing should show computed stresses (based on applying a system of loads) and the design composition of individual members (based on applying assumed unit stresses)
<b>stringer</b>	a longitudinal beam supporting the bridge deck and, in large or truss bridges, it is framed in or is on the floor beams
<b>structural members</b>	ties, beams, columns or struts, or any combination of the three
<b>structural shapes</b>	rolled iron and steel with various cross-sectional shapes adapted to the construction of metal members
<b>structural T</b>	a T-shaped, rolled member that is formed by cutting a wide flange longitudinally along the centerline of the web
<b>structure metal</b>	<i>see</i> <b>base metal</b>
<b>strut</b>	a piece or member acting to resist compressive stress
<b>strut sash</b>	<i>see</i> <b>sash brace</b>
<b>stub abutment</b>	an abutment that is in the top portion of the end of an embankment or slope and is quite short as a result. Often supported on piles driven through the underlying embankment or <i>in situ</i> material, stubs may be founded on gravel fill, the embankment, or natural ground
<b>subpanel</b>	<i>see</i> <b>panel</b>
<b>subpunched and reamed work</b>	structural steel shapes or assembled members or structures with rivet holes that are punched a specified dimension less in diameter than the nominal size of the rivets to be driven in and subsequently reamed to a specified diameter greater than the rivet size
<b>subsill</b>	<i>see</i> <b>mud sill</b>



---

<b>substructure</b>	the part of a bridge superstructure that is constructed to support a span or spans
<b>sump</b>	a pit or tank-like depression or receptacle into which water is drained. The water may then be pumped or siphoned for removal
<b>superelevation</b>	the transverse inclination of a roadway's surface in a horizontal curve and the relatively short, adjacent tangent lengths required for full development. Superelevation allows resistance to the centrifugal forces of moving vehicles
<b>superstructure</b>	the part of a bridge structure that primarily receives and supports highway, canal, railway, or other traffic loads and transfers the resulting reactions to the bridge substructure
<b>surcharge</b>	an additional load placed atop existing earth or dead loads. With abutments and retaining walls, the surcharge is replaced by an earth load of equivalent weight
<b>surface face</b>	<i>see</i> <b>mortar</b>
<b>suspended span</b>	a superstructure span with one or both ends supported on or from adjoining cantilever arms, brackets, or towers. This span is unaffected by stress transmission to or from an adjacent structure
<b>suspender</b>	a cable, a rod, or a bar that engages a cable band or another device, connecting it to the main suspension member of a suspension bridge at one end and a member of the bridge floor system at the other. The suspender transfers loads to the main suspension members of the structure, helping to support the floor system and its loads. A suspender is a member that supports another member in a horizontal or an inclined position against sagging, twisting, or other deformation due to its own weight. <i>See also</i> <b>hanger</b>
<b>suspension bridge</b>	a bridge in which the floor system and its incidental parts and appliances are suspended on cables supported at two or more locations on towers and anchored at their extreme ends. These cables (which are the main suspension members) support the floor system horizontally
<b>suspension cable</b>	one of the main members supporting the floor system of a suspension bridge. The cable ends may be fixed at the tops of backstay towers that resist the horizontal components of the cable or chain stresses, or the cable may rest on saddles at the tops of two or more towers and be extended and fixed on anchorage members
<b>suspension chain</b>	<i>see</i> <b>suspension cable</b>
<b>SW</b>	well-graded sands; a gravelly sand mixture with 5 percent or less of fines
<b>sway anchorage</b>	a guy, stay cable, or chain that is attached at an intermediate location on the floor system of a suspension bridge and anchored on the end portion of an abutment or pier or in the adjacent land surface to increase the resistance of the suspension span to lateral movement
<b>sway brace</b>	a component attached at an angle to the vertical components of a pile or bent, connecting it with the ground surface or sill for support. <i>See also</i> <b>bracing</b>
<b>sway cable</b>	<i>see</i> <b>sway anchorage</b>

<b>sway frame</b>	a sway bracing panel or frame. <i>See also</i> <b>bracing</b>
<b>swedged anchor bolt</b>	an anchor bolt with traverse and diagonal niches to hold it in place
<b>swing bridge</b>	a bridge with a superstructure that revolves in a horizontal plane on a pivot from a closed to open position. Its alignment is very similar to the original alignment. A swing bridge is a structure, with its substructure skewed, that commonly allows revolution in only one direction through an arc less than 90 degrees
<b>swing span</b>	a superstructure supported on a pier at its center, with its end supports withdrawn or released. This span is equipped to be revolved in a horizontal plane to provide an unobstructed waterway for navigation. <i>See also</i> <b>movable bridge</b>
<b>swing-span pivot</b>	the center casting that the movable portion of a swing span revolves on or about in making a cycle. In a center-bearing span, this casting acts both as a pivotal member and as the support for the movable span when the end-lift device is released. In a rim-bearing span, the swing span acts as a pivotal member but does not support the movable span. In a combined center- and rim-bearing span, the swing span acts as a support for a portion of the weight of the movable span when the end-lift device is released
<b>T</b>	tracked
<b>tack weld</b>	a butt, fillet, or seam weld intended only to fix an element or member of a structure in correct adjustment and position before full welding. Tack welds may restrain welded parts against deformation and distortion caused by expansion of the metal
<b>tail lock</b>	<i>see</i> <b>shear lock</b>
<b>tail pit</b>	<i>see</i> <b>counterweight well</b>
<b>tailwater</b>	water that is ponded below the outlet of a culvert, pipe, or waterway to reduce the amount of waterway flow. Tailwater is expressed in terms of its depth. <i>See also</i> <b>headwater</b>
<b>tan</b>	tangent
<b>TCMS</b>	Theater Construction Management System
<b>telltale</b>	a traffic-control device used to show the driver if the vehicle exceeds horizontal-clearance restrictions for a bridge
<b>temporary bridge</b>	a structure built for emergency or interim use to replace a previously existing bridge that is demolished or unserviceable due to flood, fire, wind, and so forth or to supply bridge service required for a relatively short period
<b>tendon</b>	a prestressing cable or strand
<b>tension</b>	an axial force or stress caused by equal and opposite forces pulling at the ends of the members
<b>threaded anchor bolt</b>	an anchor bolt that is shaped with a machine-cut thread. The thread anchorage uses a nut or a nut and anchor plate when the bolt is to be built into the masonry instead of being set in a drilled hole
<b>three-hinged arch</b>	an arch with end supports pinned and a third hinge (pin) located somewhere near midspan, making the structure determinate
<b>throat</b>	the dimension normal to the sloping face of a fillet weld between its heel and the sloping faces

---

<b>through bridge</b>	a bridge with its floor located between the two sides of the superstructure, causing traffic to pass through the structural members
<b>through cut</b>	<i>see cut</i>
<b>tide gate</b>	<i>see floodgate</i>
<b>tie bar</b>	<i>see tie rod</i>
<b>tie plate</b>	<i>see stay plate</i>
<b>tie rod</b>	a rod or bar in a truss or other frame that transmits tensile stress
<b>tie wall</b>	<i>see spandrel tie wall</i>
<b>TM</b>	technical manual
<b>TO</b>	theater of operation
<b>toe of a slope</b>	the place where the sloped surface of an approach cut, an embankment, a causeway, or another area intersects with natural or artificial ground surface at a lower elevation
<b>toe wall</b>	a low retaining wall placed near the toe of a slope to produce a fixed end point, to protect against erosion and scour, or to prevent water-debris accumulation
<b>toggle joint</b>	a mechanical arrangement where two members are hinged together at a central location and separately at their opposite ends. Their alignment forms an obtuse angle, causing a force applied at the common hinge to produce a lateral thrust at the end hinges directed by the original force
<b>tolerance</b>	a range or variation in physical or chemical properties that is determined to be permissible for construction materials
<b>top</b>	<i>see pier cap</i>
<b>TOP</b>	land-force tactical doctrine and operational procedures
<b>tower</b>	a pier or frame that supports the cables or chains of a suspension bridge at the end of a span; a frame acting as an end support, guide frame, and counterweight support for a vertical lift span during an operating cycle; a three-dimensional substructure framework in a viaduct with the vertical bents at its ends joined longitudinally by struts and braces, enabling the structure to resist forces acting longitudinally on the structure; a four-sided frame supporting the ends of two spans or one complete span (tower span) and the ends of two adjacent spans of a viaduct, with its column members strutted and braced in the tiers and the planes of two or four sides battered
<b>track girder</b>	one of the plate girders or trusses that is intended to provide support for the movable span throughout a cycle. The tread casting fitted on its top flange or chord forms the track on which the segmental girder moves. <i>See also segmental girder</i>
<b>track plate</b>	the plate on which the segmental girder of a rolling lift span rolls
<b>track segment</b>	one of the pieces of the circular track that supports the balance wheels of a center-bearing swing span or the drum-bearing wheels of a drum or combined center- and drum-bearing spans
<b>TRADOC</b>	Training and Doctrine Command

<b>trailing wheel</b>	<i>see</i> <b>balance wheel</b>
<b>transition length</b>	the tangent length within which the change from a normal to a superelevated roadway cross section is developed
<b>transverse bracing</b>	the bracing assemblage engaging the columns of trestle and viaduct bents and towers in perpendicular or slightly inclined planes and in the horizontal planes of their sash braces. This bracing resists the transverse forces of wind, lateral vibration, and traffic movements that produce lateral movement and deformation of the united columns. <i>See also</i> <b>bracing</b>
<b>transverse girder</b>	<i>see</i> <b>cross girder</b>
<b>transverse system</b>	<i>see</i> <b>transverse bracing</b>
<b>trapezoidal abutment</b>	<i>see</i> <b>straight abutment</b>
<b>travel way</b>	<i>see</i> <b>roadway</b>
<b>traverse drawbridge</b>	<i>see</i> <b>retractile drawbridge</b>
<b>tread plate</b>	the plates attached on the bottom flange of a drum girder, shaped to form a circular surface with a uniform bearing on the drum rollers. These plates transfer the live and dead loads of the superimposed structure to the rollers. The assemblage is sometimes termed the <i>upper track</i>
<b>tremie</b>	a long trunk or pipe with a hopper at its upper end that is used to place concrete underwater. <i>See also</i> <b>foundation seal</b>
<b>tremie concrete</b>	the concrete placed underwater by use of a tremie
<b>trestle</b>	a bridge structure with beam, girder, or truss spans supported on bents, which may include two or more tiers. Trestle structures are designated by the material and characteristics of their principal members
<b>triangular truss</b>	<i>see</i> <b>Warren truss</b>
<b>trunnion</b>	in a bascule bridge, the assemblage of a pin fitted into a supporting bearing and forming a hinge or axle on which the movable span swings during its cycle
<b>trunnion girder</b>	the girder supporting the trunnions on a bascule bridge
<b>truss</b>	a jointed structure with an open, built web arranged so that the frame is divided into a series of triangular figures and its component straight members are primarily stressed only axially. The connecting pins are assumed to be frictionless
<b>truss bridge</b>	a bridge with a truss for a superstructure. The ordinary single span rests on one support at each end (which may be abutments, piers, bents, or towers or any combination of these). The superstructure span includes the trusses, the flow system, and the bracing
<b>trussed beam</b>	a beam that is reinforced by one or more rods on its tension side (attached at or near its ends) and passing beneath a support at the midlength of the span, producing in effect an inverted king-post truss. <i>See also</i> <b>queen-post truss</b>
<b>trussed girder</b>	<i>see</i> <b>king-post truss</b>
<b>truss panel</b>	<i>see</i> <b>panel</b>

---

<b>tubular truss</b>	a truss with chords and struts composed of pipes or cylindrical tubes
<b>Tudor arch</b>	a modification of the gothic arch produced by adding shorter radius cylinder segments at the haunches, thus making it a four-centered form or type. <i>See also</i> <b>gothic arch</b>
<b>turnbuckle</b>	a device used to connect the elements of adjustable rod and bar members
<b>two-hinged arch</b>	an arch with a pinned connection at each support
<b>U-bolt</b>	a round or square bar that is bent in the shape a U and fitted with threads and nuts at its ends
<b>underpass</b>	<i>see</i> <b>overpass</b>
<b>unit stress</b>	the stress per square inch (or another unit) of the surface or cross-sectional area
<b>uplift</b>	a negative reaction or force that lifts a beam, a truss, a pile, or other bridge elements
<b>upper track</b>	<i>see</i> <b>tread plate</b>
<b>US</b>	United States
<b>USACE</b>	United States Army Corps of Engineers
<b>USAES</b>	United States Army Engineer School
<b>U-wing wall</b>	a wall placed parallel to the alignment of the approach roadway
<b>vertical curve</b>	a curve in the profile location that defines the elevation
<b>vertical hip</b>	the vertically placed tension member engaging the hip joint of a truss and supporting the first panel floor beam in a through-truss span or the bottom chord only of a deck-truss span
<b>vertical-lift bridge</b>	a bridge with a superstructure that can be raised or lowered vertically by cables, chains, or other mechanical devices, with its ends seated on bridge-seat pedestals. <i>See also</i> <b>movable bridge</b>
<b>viaduct</b>	a bridge structure consisting of beam, girder, truss, or arch spans that are supported on abutments with towers and bents, piers, or any combination of these supporting parts. Though a viaduct generally seems to be higher than a trestle, this is not usually so. A viaduct may be exactly like a multispan bridge
<b>Vierendeel truss</b>	a rigid frame with an assemblage of rectangles and trapezoids but no diagonal members
<b>voided unit</b>	a precast concrete-deck unit with cylindrical voids to reduce dead load
<b>voussoir</b>	one of the truncated wedged stones composing a ring course in a stone arch. The facing or head voussoirs are placed at the ends of a ring course
<b>voussoir arch</b>	a hingeless arch with both supports fixed against rotation. Originally, built of voussoirs (wedge-shaped stone blocks), the hingeless arch may also be concrete
<b>W</b>	wheeled

<b>wale</b>	a wooden or metal piece or assemblage placed inside and/or outside the wall of a cofferdam, crib, or similar structure, usually in a horizontal position to maintain shape and increase rigidity, stability, and strength. An assemblage of wale pieces is termed a <i>waling</i>
<b>wale piece</b>	<i>see</i> <b>wale</b>
<b>waling</b>	<i>see</i> <b>wale</b>
<b>walk</b>	<i>see</i> <b>inspection ladder</b>
<b>Warren truss</b>	a parallel-chord truss that is developed for metal bridge structures in which the web system is formed by a single triangle. It has no counters, but web members near the center of a span can be subjected to stress reversals. It may include verticals
<b>water table</b>	the upper limit or elevation of groundwater that saturates a part of a soil mass
<b>waterway</b>	the available unobstructed width for the passage of water beneath a bridge. In a multispan bridge, the available width is the total unobstructed waterway lengths of the spans. <i>See also</i> <b>clear span</b>
<b>wearing course</b>	<i>see</i> <b>wearing surface</b>
<b>wearing surface</b>	the surface of a roadway that is in direct contact with traffic and that resists the resulting abrading, crushing, or other disintegrating action
<b>web</b>	the stem of a dumbbell or solid wall pier or the part of a beam located between and connected to the flanges or the chords. The web resists shear stresses
<b>web members</b>	the intermediate members of a truss, generally extending from chord to chord but not including the end posts. Inclined web members are termed <i>diagonals</i> . <i>See also</i> <b>counter</b>
<b>web plate</b>	the plate that forms the web element of a plate girder, built-up beam, or column
<b>wedge and pedestals</b>	an adjustable lifting mechanism with a wedge operating between an upper and a lower bearing block or pedestal
<b>wedge stroke</b>	the theoretical distance a wedge must move on its pedestal to lift the arm of a swing span a distance equal to the vertical camber of the arm, due to elastic deformation minus the portion assumed to be provided in the field erection
<b>weep hole</b>	<i>see</i> <b>drain hole</b>
<b>weep pipe</b>	<i>see</i> <b>drain hole</b>
<b>weld</b>	the process of uniting portions of one or more pieces, the elements of a member, or the members of a structure in an intimate and permanent position or status; the joint produced by the welding process
<b>welded bridge</b>	a structure in which the metal elements composing its members and their joints are welded
<b>welded joint</b>	a joint in which the assembled elements and members are welded
<b>welded structure</b>	<i>see</i> <b>welded bridge</b>

---

<b>weld layer</b>	a single thickness of weld metal composed of beads (runs) placed in contact to form a pad weld or a portion of a weld made of superimposed beads
<b>weld metal</b>	the filler metal added to the fused structure metal to produce (by coalescence and interdiffusion) a welded joint or a weld layer
<b>weld penetration</b>	the depth beneath the original surface to which the structure metal is fused in a fusion weld. <i>See also</i> <b>penetration</b>
<b>weld sequence</b>	the order required in making the welds of a built-up piece or the joints of a structure to avoid the residual stresses producing individual joint distortions and deformations of the structure or its members
<b>wheel base</b>	the axle spacing or length of a vehicle. When applied to vehicles with wheel concentrations at the ends of the front and rear axles, the wheel base is the center-to-center length of the axles or the length from the front to the rear wheels
<b>wheel concentration</b>	the load carried by and transmitted to the supporting structure by one wheel of a vehicle, a movable bridge, or other equipment or device. <i>See also</i> <b>axle load</b>
<b>wheel guard</b>	a timber piece that is placed longitudinally along the side limit of the roadway to guide vehicle wheels and to safeguard trusses, railings, and other structures outside the roadway limit from collision
<b>wheel load</b>	<i>see</i> <b>wheel concentration</b>
<b>white-way lighting</b>	the lighting provided for night illumination along a road or bridge, as distinguished from sign lighting or colored regulatory and warning lights
<b>wide flange</b>	a rolled member with an H-shaped cross section with wider flanges and a thinner web than an I-beam
<b>wind bracing</b>	the bracing systems in girder and truss spans and in towers and bents that resist the stresses of wind forces
<b>wing wall</b>	the retaining-wall extension of an abutment that restrains and holds the side-slope material of an approach causeway or embankment in place
<b>worked rubble</b>	<i>see</i> <b>rubble</b>
<b>working stress</b>	the unit stress in a member under service or design load
<b>W-shaped beam</b>	wide-flange beam